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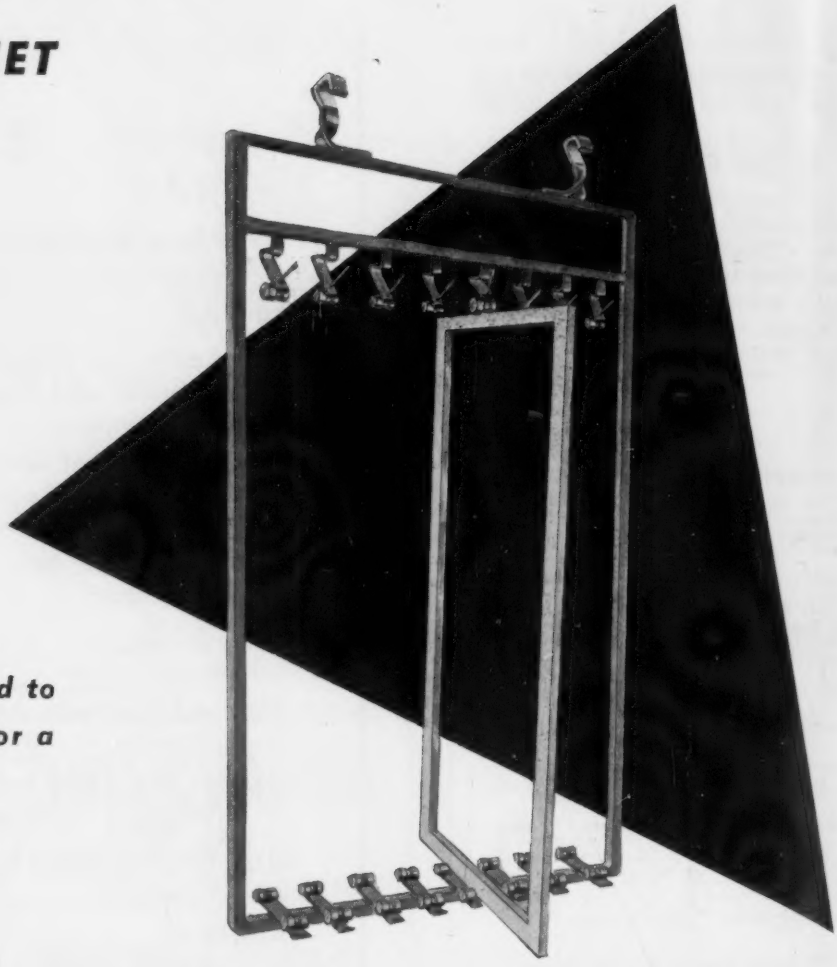

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The WASHINGTON OBSERVER

George W. Grupp

• All those firms which have neglected to make known their 1952 requirements for nickel and selenium may find it difficult, or impossible, to get their materials when they need them.

• The N.P.A. contemplates amending Cadmium Order M-19 to ease current limitation on its use. This proposed amended order will permit unlimited use of cadmium for direct defense production in the "A" through "E" and Z-2 rating categories. It will permit unrestricted use of cadmium in the production of all items now included in the "permitted use" list; and it will permit consumers to use up to 70% of the cadmium they consumed during the first half of 1950.

• A bill has been introduced in Congress which provides for research into, and demonstration of, practical means for the economical production, from sea or other saline waters, of pure water suitable for industrial purposes.

• The R.F.C. has renewed discussions with the Indonesian tin industry. The Malayans want $1.25 a pound and the R.F.C. is holding out for $1.18 a pound. Meanwhile, a South African group is seeking United States capital to exploit tin deposits in Cape Province.

• A new section, "Termination of Contracts", of Armed Services Procurement Regulation has been issued. A copy of this section may be obtained for fifty cents from the Superintendent of Documents, Government Printing Office, Washington 25, D.C.

• Two steel companies are producing "differential coated" electrolytic tinplate for food cans and other uses. They have learned how to produce over 20% more tinplate without increasing their total requirements for tin.

• The manufacturers of toys and games are expected to get increased allotments of materials during the second half of 1952.

• The Office of Technical Services of the Commerce Department has made a study of Stoddart and related solvents as to their effectiveness and as skin irritants.

• The U.S. Naval Research Laboratory has completed a study on liquid and vapor corrosion inhibitors.

• The control of lead is being eased, as evidenced by the recent amendment of Order M-38 (See Business Items section).

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METAL FINISHING

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Possibility and Probability

From time to time in these editorials we have mentioned that ugly word — "Competition"; specifically, the competition that exists between decorative plated finishes and other materials such as plastics, stainless alloys, and organic coatings. For some reason it is hard to get platers excited about the problem, the feeling being that while plastics, etc. are O.K. for some minor uses, when it comes to the rugged, major applications there can never be a substitute for good old chrome plate! We were secretly beginning to believe this malarkey ourselves. Imagine the shock to our ego when we read in a recent survey that top-level designers and materials engineers at the present time are giving serious thought to the elimination of chrome plating on *automobile bumpers*, substituting in their stead bumpers coated with colored organic coatings! Oh No, you say — this is too much; this is the crowning blow! So thought we at first, but after some serious thought on the matter we have to admit that the designers are not so far off base, at that.

True, it's been tried before and found unsatisfactory, but in the past few years we have learned much more about how to make organic coatings hard, tough, glossy, and adherent. Not as hard and tough as metallic coatings, perhaps, but many designers feel that with proper design the metallic properties of plated coatings are not at all necessary on bumpers.

And think of the color possibilities! This is a decided advantage to designers, who hate to be tied down to a single "choice." They envision the day when the little woman will have the car bumpers repainted to match her new Easter outfit!

Think of the good protection provided by such coatings! Never anything to really brag about, today's chrome finishes are worse than ever.

Think of the economy! Cheaper grades of steel, and savings in surfacing operations, cleaning, and plating steps can amount to real savings.

Think of the ease of repair! For the car owner himself there are the new beer-can-type pressurized paint containers, to mention only one possibility.

Think of the saving in metals which are scarce now and very apt to get scarcer still in the coming months!

Admittedly, the public will first have to be "educated" into accepting non-chrome finishes, but emergencies are always a good time to get new and radical things accepted. The increasing number of failures of chrome finishes, which platers are presently helpless to prevent, could hasten such acceptance materially. Once firmly entrenched, a good organic finish would be hard to replace again, especially with the trend towards cutting costs wherever possible.

To make it even worse, such other automotive items as radiator grilles, headlamp bezels, hub caps, and trim have requirements which are even easier for organic finishes to meet!

Is it any wonder that we keep harping on the fact that the challenge to the plating industry is today greater than ever? A superior plated finish — or no plated finish at all — should be the password for the whole industry. What may be just a designers "dream" today could easily be the accepted thing a few years hence.

W. A. Raymond

Editor

The Analysis of Chromium Plating Baths Containing Fluorides and Fluosilicates

By H. A. van Oosterhout and E. J. C. van de Velde, *Nieuw Loosdrecht, Holland.*

H. A. van Oosterhout

IN order to obtain chromium deposits of high quality, regular analysis of the chromic acid plating bath is necessary. Especially in hard-chromium plating, the use of chromium baths with fluorides as addition agents has a great advantage, as the current efficiency of these solutions is higher than that of the sulfuric-acid bath. Also in barrel plating, and more and more in bright plating, the fluosilicic type is used. Two analytical methods are discussed and the results are compared. The distillation method is preferred as the results are very reliable.

E. J. C. van de Velde

Introduction

a) THE CHROMIC-SULFURIC ACID BATH.

Only one chromium plating solution is of industrial interest, viz. the chromic-acid solution. In 1854 *Bunsen* obtained chromium deposits by electrolyzing a boiling solution of chromi-chloride. A large number of experiments were made in order to find a method of commercial interest. *Mazzuchilli* worked with an ammonium-chromi-oxalate solution[1] and *Gunther* tried to obtain good deposits from a CrO_3 solution.

In 1899 however, *Reese* found that from a solution containing only chromic-acid no metal could be deposited.[2]

Varveth and *Currey* got good results with a chromic-acid solutions containing small amounts of sulfuric acid[3] and obtained a current efficiency of about 14%. It was, however, not before 1920 that *Sargent* obtained results of technical importance.[4] At that time the commercial development of chromium plating began.

b) THE CHROMIC-FLUORIC ACID BATH.

Harring and *Barrows* found[5] that the sulfuric acid could be replaced by fluorides. Solutions containing only fluoric acid, however, are reliable, as the deposits are very often dull. Addition of sulfuric acid eliminates the defect. Instead of sulfuric acid, fluosilicic acid can be used.

c) THE CHROMIC-FLUOSILICIC ACID BATH.

Chromium deposits from fluosilicic chrome baths have about the same mechanical properties as those obtained from the sulfuric acid bath.[7] In contrast with the deposits obtained from the sulfuric acid solution, the deposits from the fluosilicic bath can be replated without any loss of brightness.[8] This is the reason why the fluosilicic solution is used in barrel plating, as contact is often interrupted. Another advantage of the fluosilicic solution is the higher current-efficiency. Especially in the hard chromium trade this is a very important factor, as very thick deposits can be obtained in a considerably shorter time. Another important fact is that the covering power of the fluosilicic bath is better than the sulfuric acid solution.

A disadvantage of this type of solution is that iron is more readily attacked than by the sulfuric acid bath. In cases of a partial build up of machine parts, sometimes attack of the base metal occurs at the zone of the stop-off material. When articles have to be plated onto the whole surface, however, this phenomenon cannot occur, and thicker deposits are obtained in a rather shorter time than with the sulfuric-acid solution.

The 7% antimony-lead anodes used in chromium plating are attacked by the hydro-fluosilicic-acid,[9] however without contaminating the solution. The use of anodes containing up to 12% antimony or tin is therefore suggested.

Some authors speak about a very short life of the fluosilicic solution, but results obtained by *Gebauer & Sommer* are contrary to these statements.[10]

As with the sulfuric acid solution, the hydro-fluosilicic bath has to be analyzed regularly.

d) CHROMIUM PLATING SOLUTIONS CONTAINING COMBINATIONS OF SULFURIC-, FLUORIC- AND FLUOSILICIC-ACID.

As stated above, the chromic acid solution containing only fluoric acid does not give reliable results. Often combinations of H_2SO_4-HF, H_2SO_4-H_2SiF_6 and H_2SO_4-HF-H_2SiF_6 are used.

At the right concentration and working conditions, current efficiency of up to 26% can be reached, thus opening wide aspects for the chromium deposition.

The Chemical Properties of Fluoric and Hydrofluosilicic Acid

a) FLUORIC ACID.

The strength of fluoric acid is about the same as that of formic acid. Hence a solution of fluoride salts,

for instance NaF, KF or NH_4F, are slightly alkaline. Characteristic for fluorides is the tendency to form complexes.[11]

$(Ti{\equiv}F_6){\equiv}$, $(V{\equiv}F_6){\equiv}$, $(Zr{\equiv}F_6)^{=}$, $(Zr{\equiv}F_5OH)^{-}$, $(Al{\equiv}F_6){\equiv}$, $(Fe{\equiv}F_6){\equiv}$, $(Ti{\equiv}F_6)^{=}$, $(BF_4)^{-}$, $(Nb{\equiv}F_6)^{-}$, $(TaF_6)^{-}$,

With zirconium, fluorides form a very strong complex. When zirconium nitrate is added to the solution of one of the complexes mentioned above, the zirconium complex is formed. With calcium salts, fluorides form insoluble CaF_2; this reaction can be used for the gravimetric estimation of NaF.

Fluorides react with sand and sulfuric acid giving silicon-tetra-fluoride

$$4NaF + SiO_2 + 2H_2SO4 \rightarrow 2Na_2SO_4 + 2H_2O + SiF_4$$

After volatilization of SiF_4, fluoride can be estimated volumetrically with thorium-nitrate.

b) Fluosilicic acid.

Fluosilicic acid is known only in aqueous solution. It is prepared by decomposing silicon-tetrafluoride with water.

$$3SiF_4 + 3H_2O \rightarrow H_2SiO_3 + 2H_2SiF_6.$$

A solution of Na_2SiF_6 reacts with concentrated sulfuric acid, forming fluoric acid and silicon tetrafluoride.

$$Na_2SiF_6 + H_2SO_4 \rightarrow Na_2SO_4 + SiF_4 + H_2F_2.$$

Diluted H_2SO_4 does not react. Barium chloride forms insoluble $BaSiF_6$. (Sulfuric acid correction with $BaCO_3$ can give difficulties, as $BaSiF_6$ may be precipitated).

When a solution of Na_2SiF_6 is boiled with ammonium hydroxide $Si(OH)_2$ is formed. This reaction can be used for the estimation of fluosilicates.

$$SiF_6^{=} + 4OH^{-} \rightarrow 6F^{-} + H_2SiO_3 + H_2O.$$

Potassium or sodium hydroxide reacts already at room temperature.

With sodium alizarine sulfonic-acid, zirconium nitrate forms, even in concentrated hydrochloric acid, a red-colored stable compound, which can be used for detecting 0.0001 mg. of fluoride.[12] When fluoride is added to a solution containing the zirconium-sodium alizarine sulfonate complex, the red color disappears as the $(Zr{\equiv}F_6)^{=}$ complex is formed.

On this reaction the titration of fluosilicic acid is based.

Analytical Methods

A batch solution was prepared with a known amount of CrO_3 — Cr_2O_3 — H_2SO_4 — NaF and/or Na_2SiF_6 and Fe, and the quantities of the various components were estimated before and after addition of the fluorine compounds in order to find out if these compounds interferred with the various analysis. See Table I.

Table I.

Number		*Found before addition of NaF or Na_2SiF_6.*	*Found after addition of NaF or Na_2SiF_6.*	
9LA-981	CrO_3	250 g./l.	250 g./l.	250 g./l.
	Cr_2O_3	7 "	7 "	7 "
	H_2SO_4*	0.54 "	0.50 "	0.52 "
	Fe*	3 "	3 "	3 "
	NaF**	—	4.0 "	—
	Na_2SiF_6**	—	—	6.0 "

*gravimetrically.
**distillation method.

The various components were estimated by methods described below.

a) *Cromic acid.*

Chromic acid was estimated with iodine — thiosulfate as described by *Blum* and *Hogaboom*.[13]

b) *Chromi oxide.*

After preciptating $Cr^{\equiv}$ and $Fe^{\equiv}$ and filtration of the precipitate, $Cr^{\equiv}$ was oxidized and estimated as Cr^{VI} with iodine-thiosulfate.[13]

c) *Iron.*

Iron was estimated colorimetrically with the aid of a photo-colorimeter, using KCNS as reagent. The method is described by *W. J. Bayley*.[14]

d) *Sulfuric acid.*

Sulfuric acid can be estimated either turbidimetrically with the aid of a photo-electric colorimeter or gravimetrically by the method of *F. W. Salt*.[15]

The gravimetric procedure is very rapid, giving reliable results. The method has been successfully used for several years in our analytical laboratory. Sometimes, however, the $BaSO_4$ precipitate was colored by adsorption of picric acid, and the values obtained differed from those found by the turbidimetric method. It was found that this could be overcome by adding more hydrochloric acid at the beginning. So in order to precent adsorption of picric acid, 25 ml. HCl was added.

The procedure is as follows:

From a sample of the plating solution 20 ml. are pipetted in a 300 ml. beaker. The solution is then diluted with 75 ml. water. Then 25 ml. hydrochloric acid, 50 ml. acetic acid (50%) and 25 ml. ethyl alcohol are added. The solution is boiled for 10 minutes and then diluted with about 30 ml. water after 5 ml. of a saturated aqueous solution of picric acid has been added. (This solution is prepared by dissolving 16 g. picric acid in 1 L. water at 100°C.; the solution is then cooled. Crystals of picric acid are formed.) Thereafter 10 ml. of a barium chloride solution (10%) at about 90°C. is added while stirring. After boiling the solution, the $BaSO_4$ precipitate is immediately filtered, washed and dried. For filtration a glass sintered crucicle (#4) can be used.

e) *Fluoric Acid-Gravimetric.*

Fluorides and fluoric acid can be estimated gravimetrically with $Ca(OH)_2$ as CaF_2, or volumetrically by titration with thorium nitrate.

Experiments carried out in our analytical laboratory with the calcium hydroxide method showed that this method gives errors of more than 50%. Although the concentration of the fluor compounds in chromium plating solutions is not as critical as the sulfuric acid addition, it is clear that this method is not suited for plating baths. The method is moreover rather complicated.

After diluting, the chromic acid is reduced by hydrogen peroxide and after nuetralization, the iron hydroxide which is formed is filtered off. With a freshly prepared boiling solution of calcium hydroxide the fluoride is precipitated. This can be weighed as CaF_2

after ignition. The exact amount of CaF_2 is estimated by titration of the precipitate with hydrochloric acid and methyl orange as indicator.

This method has the following disadvantages.

The reduction with H_2O_2 takes place very slowly and is often incomplete.

The filtration of the $Fe(OH)_3$ and CaF_2 takes up too much time.

f) *Fluoric Acid-Volumetric Method.*

Fluorides can be estimated volumetrically by a steam distillation of the plating solution and titrating the volatilized fluoride with thorium nitrate. This method has been described by *Willard.*[16] *Reynolds* and *Hill*[17] studied the influence of some acid radicals and found that $H_2PO_4^-$ $SO_4^=$ and ClO_4^- interferred. Silicate had no effect. *Wagner* published the same method[18] for chromium plating solutions without using a steam distillation.

Results are very reliable and the analysis can be carried out in a short time.

As steam is led through, enough liquid can be distilled, assuring a complete distillation of the fluorine compounds.

The apparatus used is shown in Figure I. In the Kjeldahl flask the solution is mixed with sand and concentrated sulfuric acid. The following reaction takes place:

Fluosilicic compounds:

$$2Na_2SiF_6 + 2H_2SO_4 + SiO_2 \rightarrow 2Na_2SO_4 + 2H_2O + 3SiF_4$$

Fluoride compounds:

$$4NaF + SiO_2 + 2H_2SO_4 \rightarrow 2Na_2SO_4 + 2H_2O + SiF_4$$

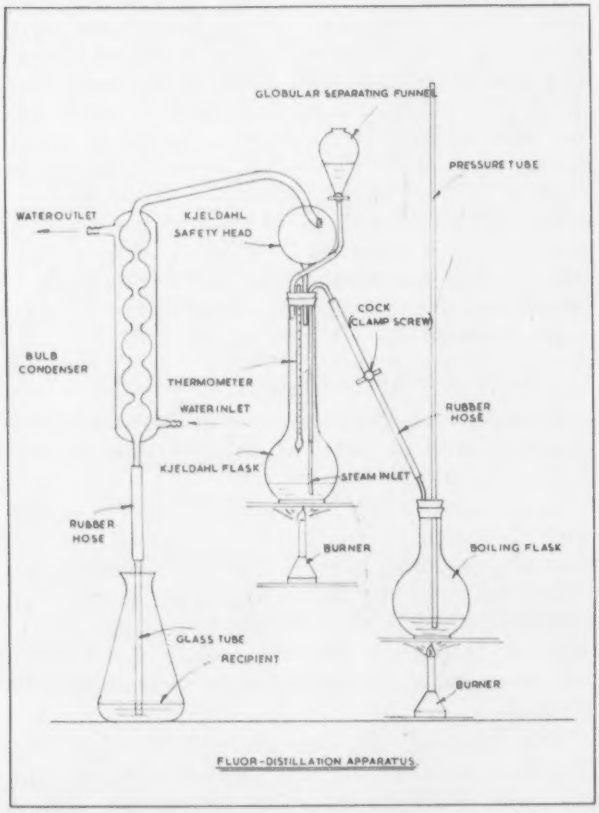

Figure 1. Sketch of the distillation apparatus used for the determination of fluorides.

The distillate is titrated with thorium nitrate, using the zirconium nitrate-sodium alizarine sulfonate complex as indicator (ZrSAS complex) — $Zr(NO_3)_4$ forms with fluorides the very stable $ZrF_6^=$ complex and the red color of the ZrSAS complex disappears. During the titration with $Th(NO_3)_4$, after addition of alcohol, ThF_4 (insoluble in alcohol) is formed. When all the fluorine is precipitated the ZrSAS complex is again formed. The reactions are:

$$6F^- + [Zr(NO_3)_4 - C_{14}H_8(OH)_2O_2SO_3Na]^* \rightarrow ZrF_6^= + 4NO_3^- + C_{14}H_8(OH)_2O_2SO_3Na^{**}$$

*Zr — Na — alizarine sulfonate (pink)
**Na — alizarine sulfonate (yellow)

$$2ZrF_6^= + 3Th(NO_3)_4 \rightarrow 3ThF_4 + 4NO_3^- + 2Zr(NO_3)_4$$

(forms the red ZrSAS complex)

insol. in alc.

yellow → pink

Table II.

Results obtained with a solution containing a known amount NaF.

Number	*NaF added*	*NaF found**
11-B-5	4.0 g./l.	4.0 g./l.
		4.1 g./l.
11-B-42	8.0 g./l.	8.2 g./l.
		7.9 g./l.

*distillation method.

The procedures is as follows:

10 ml. sample is pipetted into a 500 ml. Kjeldahl flask. About 3 g. sand and a few pumice stones are added. After addition of 20 ml. H_2SO_4 and 80 ml. H_2O the solution is heated to 125°C. At that temperature steam is led through. If the temperature is lower not all the fluorine is volatilized; too high a temperature gives a yellow coloration of the distillate, due to CrO_3. If the droplet in the safety head is yellow, the steam inlet is stopped and some water from the separating funnel is added, in order to lower the temperature of the solution in the Kjeldahl flask. In about 1½ hours 200-300 ml. are distilled. The distillate is mixed with 0.2 ml. indicator and neutralized with NaOH till a pink color is obtained. Now the solution is acidified and again neutralized. Fifteen ml. alcohol (normal methylated spirit) is added and again some HCl, till yellow. After addition of 10 ml. alcohol and again 0.1 ml. of the indicator the distillate is titrated with $Th(NO_3)_4$ till a pink color is formed. The used volume of the $Th(NO_3)_4$ solution is multiplied by the factor. This factor can be estimated either by using a NaF solution or by distilling a solution with a known amount of Na_2SiF_6 or NaF.

The following reagents are used:

1. *Thorium nitrate.*
   75 g. $Th(NO_3)_4 \cdot 12H_2O$ are dissolved in water and diluted to exactly one liter.
2. *Hydrochloric acid.*
   HCl diluted 1:50.
3. *Sodium hydroxide.*
   NaOH 20 g. in 1 L. water.

Figure 2. A corner of the plating solution analytical laboratory at N.V. Metallic Industry, Hilversum, Holland.

4. *Zirconium nitrate.*

   4 g. $Zr(NO_3)_4$ in 1 L. water.

5. *Sodium-alizarine-sulfonate.*

   2 g. $C_{14}H_8(OH)_2O_2SO_3Na$ dissolved in 200 ml. alcohol. After filtration the solution is diluted to 300 ml. with alcohol.

6. *Ethyl alcohol.*

The indicator is prepared by mixing 3 ml. Zirconium nitrate and 2 ml. Na-alizarine-sulfonate solution shortly before use.

g) *Fluosilicic acid.*

Table III.

Results obtained with solutions containing a known amount Na_2SiF_6 (distillation method).

Number	*Na_2SiF_6 added*	*Na_2SiF_6 found*
10-B-1107	4.0 g./l.	3.9 g./l.
		4.0 g./l.
10-B-1108	6.0 g./l.	5.9 g./l.
		5.9 g./l.
		4.6 g./l.*
10-B-1109	8.0 g./l.	7.9 g./l.
		8.1 g./l.
10-B-1112	10.0 g./l.	9.9 g./l.
		9.9 g./l.

*temperature too low (115°C.)

h) *Mixtures of H_2SO_4 — NaF — Na_2SiF_6*

When a chromium plating solution containing H_2SO_4 — NaF — Na_2SiF_6 is to be analyzed the following procedure can be used:

H_2SO_4—normal method.

Na_2SiF_6—estimation as H_2SiO_3

NaF—the total fluorine content is estimated by the distillation method. After subtraction of the fluorine derived from the gravimetric Na_2SiF_6 estimation NaF can be calculated.

Fluosilicic acid or salts can be estimated volumetrically with the distillation method described above, or gravimetrically as H_2SiO_3. With the distillation method the total fluorine content is estimated (Na_2SiF_6 + NaF).[19]

This gravimetric analysis is carried out as follows:

To 20 ml. of the solution (in a platinum bowl) ammonium hydroxide in a slight excess is added. Now 20 ml. of a saturated NaCl solution is added and the whole is heated on a water-bath just till H_2SiO_3 precipitates. Iron and chromium also precipitate, thus making it difficult to state if H_2SiO_3 is formed. The precipitate is filtered. The precipitate is poured back

(*Concluded on page 69*)

Table IV.

Results obtained with solutions containing a known amount NaF or Na_2SiF_6 and Fe.

Number of Test	*Added gm/l.*			*Found gm/l.*		
	NaF	*Na_2SiF_6*	*Fe.*	*NaF*	*Na_2SiF_6*	*Fe*
11-B-88	4	—	5	3.8	—	4.9
				3.8		
11-B-94	4	—	13	4.1	—	13.1
			5	4.1		
11-B-90	8	—	5	7.9	—	4.9
				8.2		
11-B-126	—	4	5	—	3.9	4.9
					4.0	
11-B-128	—	8	5	—	7.4	not estimated
					7.9	
					7.9	
11-B-129	—	4	13	—	3.9	not estimated
					3.7	
11-B-131	—	8	13	—	8.1	12.9
					7.9	
11-B-167	4	6	5	3.9*	6.1†	not
				3.8*	5.9†	estimated
11-B-196	2	4	13	1.8*	3.8†	not
				2.2*	4.0†	estimated

†gravimetrically
*distillation method.

The Formation of Metallic Coatings by Vapor-Phase Techniques

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Introduction

RECENT advances in industrial utilization of high-temperature processes have stimulated the development of refractory metals and alloys and methods of their fabrication. This has, in turn, stimulated the development of methods for applying coatings of the refractory metals since, for many applications, the use of a refractory coating on a less refractory base is preferable to the use of the refractory metal alone; in some cases, fabrication difficulties actually preclude the use of the massive refractory metal.

Unfortunately, conventional coating processes are not readily adapted to use in forming coatings of the refractory metals. Numerous attempts to electrodeposit titanium, zirconium, columbium, tantalum, molybdenum, and tungsten have been reported in the literature. Most of these have been unsuccessful, however, and in no case have heavy, adherent deposits of the pure metals been obtained. Flame spraying, sintering powder coatings, and evaporation have been tried with some success, but normally lead to porous coatings unless an alloy coating is obtained by reaction with the base.

The most versatile processes for applying coatings of the refractory metals are the vapor-deposition processes. They were first used about sixty years ago by the incandescent lamp industry in attempts to develop a satisfactory tungsten lamp filament.[1] In the vapor- deposition processes, the coating is formed by chemical reaction, usually reduction or thermal decomposition, of a plating atmosphere at the heated surface of the base material. The vapor-deposition processes can be used to deposit coatings of the most refractory metals at temperatures far below their melting points, or at temperatures where their vapor pressures are negligible. Coatings of a few hundredths of a mil to a quarter of an inch or more in thickness can be formed in plating times as brief as a few minutes to several hours in duration. Most vapor-deposition processes can be carried out either in a vacuum or at atmospheric pressure.

Coatings made in this way at high temperatures are frequently more adherent and stable under high-temperature operation than materials deposited at lower temperatures by other methods. For this reason, vapor-deposited chromium and nickel coatings are being used increasingly for high-temperature applications, although these metals can be more easily applied by conventional deposition.

While considered here primarily from the standpoint of coatings, these processes can also be used to form massive metal deposits on filaments of fine wire. This offers the unique advantage of permitting large, dense masses of refractory metal to be formed at relatively low temperatures and with no contamination from surrounding atmosphere or container. For a number of years, this process furnished the only supply of massive titanium and zirconium of sufficient purity to be workable.

Coating Processes and Materials

Two general plating methods are used: (a) reduction, or displacement at the surface; and (b) thermal decomposition at the surface. In Class (a) are hydrogen reduction of the metal halides, and reaction of the base material with the metal halides. In Class (b) are the high-temperature thermal decomposition of metal halides, and the low-temperature pyrolysis of metal carbonyls and hydrides .

The hydrogen-reduction processes are usually carried out as follows:

Hydrogen is passed over, or through the solid or liquid metal halide, housed in a tube or boat, and heated to such a temperature that the resultant gas mixture contains from one to 20 or 30 per cent (by volume) of metal halide vapor. This gas mixture then passes into the coating chamber and over the heated specimen, reacting at the heated surface and depositing an adherent coating of the nonvolatile reaction products. The spent gases pass on out of the chamber and are either suitably disposed of, or treated for recovery of the unused metal halides. Where operation at reduced pressure is required, the exit from the plating chamber is connected to a liquid-air-trapped vacuum pump, and hydrogen is bled into the evacuated halide vaporizer and plating chamber through a needle valve. A barometric mercury column attached to the inlet to the vaporizer is a satisfactory pressure indicator. Lower halide vaporizer temperatures are used in operation at reduced pressures in order to maintain the proper hydrogen-to-metal-halide ratio.

The thermal-decomposition processes are carried out in an analogous fashion, with an inert carrier gas being used instead of hydrogen. Higher concentrations of the metal-compound vapors can be used here than in the hydrogen-reduction processes. In reduced-pressure operation the carrier gas is frequently omitted, the metal halide or compound being distilled or sublimed through the coating chamber.

Table 1 lists the more refractory metals which have been applied as coatings by vapor-deposition processes, and the reactions and general conditions involved in these processes. While not listed, the less refractory metals such as aluminum, tin, and lead can be deposited by similar reactions.

The metal halides for these coating processes are conveniently prepared by halogenation of the metal powders, but the less expensive carbides, nitrides, carbonitrides, or oxide-carbon mixtures may be used in most cases. The carbonyl halides of the platinum-group metals are obtained by treatment of these metals, or their ores, with a carbon monoxide-halogen mixture. The metal carbonyls, except for nickel carbonyl, are

Table 1. Vapor-Deposited Metals and Deposition Reactions

Metal	*Melting Point, °C.**	*Deposition Reaction***	*Deposition Temp., °C.*	*Total Gas Pressure, mm. Hg.*
Tungsten	3410 ± 20	$WCl_6 + 3H_2 \rightarrow W + 6\ HCl$	550-1200	760 to 10
Tungsten	3410 ± 20	$W(CO)_6\ [+ H_2] \rightarrow W + 6\ CO\ [+ H_2]$	500- 800	<10
Rhenium	3170 ± 60	$ReCl_3\ [+ N_2] \rightarrow Re + 1\frac{1}{2}\ Cl_2\ [+ N_2]$	600-1800	760
Tantalum	3000 ± 50	$TaCl_5 + 2\frac{1}{2}\ H_2 \rightarrow Ta + 5\ HCl$	600-1400	760
Osmium	2700 ± 200	$Os\ X_2 \cdot YCO \rightarrow Os + X_2 + YCO$	ca. 600	0.01 to 0.02
Molybdenum	2625 ± 50	$MoCl_5 + 2\frac{1}{2}\ H_2 \rightarrow Mo + 5\ HCl$	600-1100	760 to 5
Molybdenum	2625 ± 50	$Mo(CO)_6\ [+ H_2] \rightarrow Mo + 6\ CO\ [+ H_2]$	450- 750	<0.75
Ruthenium	2500 ± 100	$Ru\ X_2 \cdot YCO \rightarrow Ru + X_2 + YCO$	ca. 600	0.01 to 0.02
Iridium	2454 ± 3	$Ir\ X_2 \cdot YCO \rightarrow Ir + X_2 + YCO$	ca. 600	0.01 to 0.02
Niobium	2415 ± 15	$NbCl_5 + 2\frac{1}{2}\ H_2 \rightarrow Nb + 5\ HCl$	600-1200	760
Tantalum-Niobium	ca. 2300	$TaCl_5 + NbCl_5 + 5\ H_2 \rightarrow Ta + Nb + 10\ HCl$	600-1200	760
Rhodium	1966 ± 3	$Rh\ X_2 \cdot YCO \rightarrow Rh + X_2 + YCO$	ca. 600	0.01 to 0.02
Chromium	1890 ± 10	$CrCl_2 + M\ [+ H_2 + HCl] \rightarrow Cr + MCl_2\ [+ H_2 + HCl]$	900-1200	20 to 760
Chromium	1890 ± 10	$CrI_2, CrI_3\ [+ He] \rightarrow Cr + I_2$	1000-1400	10^{-3} to 760
Chromium	1890 ± 10	$Cr(CO)_6\ [+ H_2] \rightarrow Cr + Cr_3C_2 + Cr_2O_3\ [+ H_2]$	450- 625	0.04 to 0.22
Zirconium	1830 ± 40	$ZrBr_4 + 2H_2 \rightarrow Zr + 4\ HBr$	1300-1500	760
Zirconium	1830 ± 40	$ZrI_4 \rightarrow Zr + 2I_2$	1300-1800	50
Titanium	1820 ± 100	$TiBr_4 + 2H_2 \rightarrow Ti + 4\ HBr$	1200-1400	760
Titanium	1820 ± 100	$TiI_4 \rightarrow Ti + 2I_2$	1200-1400	50
Thorium	1800 ± 150	$ThI_4 \rightarrow Th + 2I_2$	1700	50
Platinum	1773 ± 1	$PtCl_2 \cdot 2\ CO \rightarrow Pt + Cl_2 + 2\ CO$	600	0.01 to 0.02
Hafnium	1700 (est.)	$HfI_4 \rightarrow Hf + 2I_2$	1600	50
Vanadium	1735 ± 50	$VI_2 \rightarrow V + I_2$	1100-1200	50
Iron	1539 ± 3	$Fe(CO)_5\ [+ CO] \rightarrow Fe + 5\ CO\ [+ CO]$	370- 450	760
Nickel	1455 ± 1	$Ni(CO)_4\ [+ H_2] \rightarrow Ni + 4\ CO\ [+ H_2]$	180- 205	760
Uranium	1130	$UI_4 \rightarrow U + 2I_2$	1100-1500	0.01 to 1
Tantalum-Titanium	.....	$TaBr_5 + TiBr_4 + 4\frac{1}{2}\ H_2 \rightarrow Ta + Ti + 9\ HBr$	1200-1400	760
Tantalum-Zirconium	.....	$TaBr_5 + ZrBr_4 + 4\frac{1}{2}\ H \rightarrow Ta + Zr + 9\ HBr$	1300-1400	760

*All melting points, except that for zirconium, were taken from the ASM Metals Handbook, 1948. The melting point of zirconium was taken from "The Properties of Zirconium," by F. W. Boulger, AECD-2726, March 15, 1949.

**While balanced equations are given, stoichiometric proportions of reactants are not generally used in the hydrogen-reduction processes. A five- to forty-fold excess of hydrogen is normally used in these instances. M = Fe, Ni, Ta, Mo, W, etc.; X = Cl, Br, or I; Y = 1, 1½, or 2.

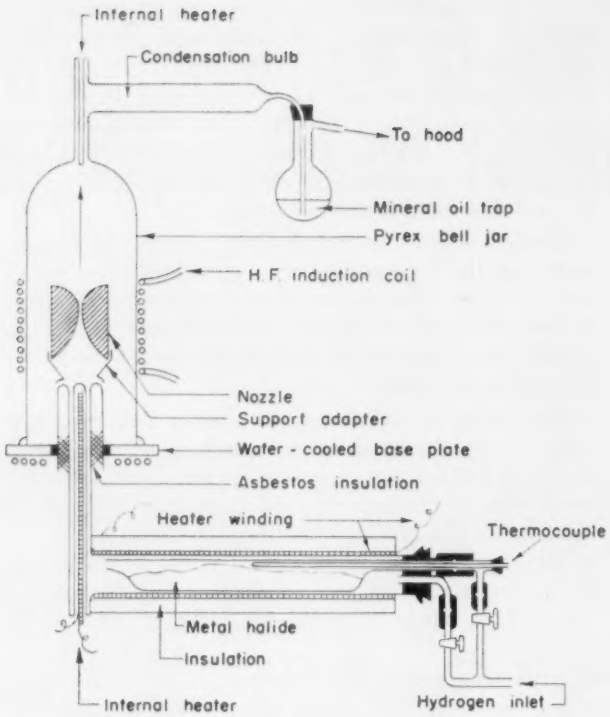

Figure 1. Nozzle-coating apparatus.

the most difficult to prepare of the plating compounds. Nickel carbonyl is prepared by treatment of nickel powder with carbon monoxide at atmospheric pressure. The sixth group metal carbonyls are prepared by treatment of the metal halides with carbon monoxide and Grignard reagent under high pressure.

Where hydrogen is used as the reducing agent in depositing the fourth, fifth, and sixth periodic group metals, it should be purified. A more satisfactory procedure where extremely high-purity coatings are desired is to prepare the hydrogen by thermal decomposition of titanium or zirconium hydride, which can be regenerated with impure tank hydrogen.[2] This latter method has the advantage of removing carbon and nitrogen as well as oxygen impurities from the gas, a matter of utmost importance if ductile deposits are to be obtained. Helium or argon, where used as a carrier gas, should also be purified. Passage over titanium powder at 850°C.[3] is a satisfactory procedure in most cases.

Coating Apparatus

Most of these processes can be carried out in Pyrex apparatus since the majority of the volatile compounds used develop the required vapor pressure below 550°C. and the samples, themselves, can usually be heated internally. Where less volatile materials such as the halides of chromium and vanadium are used, however, quartz, Vycor, or porcelain apparatus may be necessary. Metal containers, of stainless steel or Hastelloy, are satisfactory in some cases, but in other cases the corrosive nature of the reactants precludes the use of metal equipment, particularly in the plating zone.

Most coating operations are carried out as batch processes. A typical piece of equipment for this type of operation is shown in Figure 1. The object to be coated is placed inside a Pyrex or Vycor envelope or bell jar, around which is wound the high-frequency induction coil. Hydrogen is saturated with the metal halide vapor in the vaporizer at the bottom of the figure. The mixed gases enter the bell jar through the insulated and heated vertical tube. In this particular case the gas mixture is confined to the inner surface of the nozzle where the coating is desired. The spent gases are removed at the top of the bell jar, and any unused metal halides are condensed in the bulb shown, before exhausting the remaining gases.

Figure 2 shows a more complicated piece of equipment which has been used for continuous-flow operation. This has been employed in the application of tantalum, niobium, molybdenum, and tungsten coatings to continuous lengths of iron, copper, and molybdenum wires. The wire to be coated enters the apparatus through a gas or mercury seal, or stuffing gland, and is heated in an inert-gas atmosphere in the entrance inlet chamber. The hot wire enters the main plating chamber through a small hole in the entrance inlet chamber, and finally leaves the apparatus through a similar arrangement on the exit end. The wire is heated by passing an electric current through it, contact being made to the wire through rolling or sliding (mercury film) contacts located in the inert-gas chambers. The coating atmosphere enters the plating section of the tube from the centrally located vaporizer, and flows through both branches of the plating tube. The spent coating gases and the flow from the inert-gas chambers both exhaust through the bulbs on the ends of the coating tube. A motor-driven reel draws the wire through the apparatus at a steady, controlled rate. The halide-vaporizer temperature must be carefully controlled here if uniform wire coatings are to be obtained. This is accomplished by the use of a thermocouple, inserted in the vaporizer boat, actuating a controller which turns on or off a small fraction of the vaporizer heater current.

The specimen is best heated by induced high-frequency currents, or by resistance heating, the form and composition of the specimen permitting. External furnace heating can be employed in some cases, but the plating efficiency is often low because of extensive deposition on the walls of the plating chamber.

Physical Properties of Vapor Coatings

Vapor-deposited metal coatings have properties similar to those of the bulk metals of corresponding purity. Ductile deposits of all metals except Os, Ru, and possibly Ir can be obtained. Ductile tungsten and molybdenum deopsits are more difficult to obtain than ductile deposits of the other metals, however. The separate crystals of chromium and vanadium obtained by the iodide-decomposition process are ductile, but the crystals are so loosely bound together that the deposit is essentially brittle. The metals can be made hard and brittle, however (and often inadvertently are), by the addition of traces of carbon, oxygen, nitrogen, or hydrogen compounds to the plating atmosphere.

Coating Adhesion

The coating adhesion is excellent where a physical or chemical bond is formed by diffusion of, or reaction between, the coating and the base (as in chromium coatings on iron). Coatings so bonded can withstand

severe deformation without spalling, providing both the coating and the bonding layer are ductile. Some of the metals, however, can react with carbon or nitrogen in the base metal to form a brittle, poorly bonded interlayer. When the coating and the base interact, cleanliness of the surface prior to coating is relatively unimportant.

When no diffusion or reaction occurs and the bond between the coating and the base is only mechanical (as with tantalum coatings on copper), the adhesion is similar to that of electrodeposited metal, and cleanliness of the surface to be coated is highly important if adherent deposits are to be obtained.

Effect of Deposition Temperature

Of the several factors which influence the nature of the deposit, the specimen temperature seems to be most important. Lower temperatures usually favor more finely crystalline deposits. Virtually amorphous deposits are obtained at the lowest deposition temperatures, and deposits of crystals several millimeters in diameter at the higher temperatures. At high temperatures, single-crystal deposits can be obtained if a monocrystalline base is used. At medium or low temperatures, the structure of the base has little or no effect upon the form of the deposit. The maximum deposition temperature in any case is generally the melting point of the base, of the coating, or of any reaction product or solid solution formed between the base and the coating.

The specimen temperature also affects the adhesion and cohesion of the deposit. The less stable plating compounds tend to be reduced or decomposed at a considerable distance from the heated surface at the higher temperature. This produces nonadherent powder deposits, or the formation of nonvolatile decomposition products which are carried out of the plating zone before deposition can occur. The effect is especially noticeable in depositing Mo and W by hydrogen reduction of the halides, and in the pyrolysis of carbonyl and carbonyl halide compounds (Cr, Mo, W, Fe, Ni, Ru, Rh, Os, Ir, Pt). The difficulty can be eliminated by lowering the specimen temperature, or by reducing the pressure of the plating atmosphere, and thereby increasing the mean free path of the gas molecules, as well as preventing the condensation of nonvolatile partial-reduction or decomposition products.

Effect of Coating Compounds Concentration

The concentration of reactants in the atmosphere affects the crystallinity of the deposits. As a general rule, the higher this concentration is, the more finely crystalline is the deposit. The pressure of the reactants has a similar effect. Higher pressures tend to produce finely crystalline deposits. Thermal decomposition of the metal halides in vacuo usually produces deposits of crystals visible to the unaided eye, while coatings made at atmospheric pressure are usually microcrystalline.

Effect of Impurities

Impurities such as oxygen, water vapor, or oxyhalides in the plating atmosphere may exert a pronounced effect on the form of the deposit as well as its properties. Difficulty in obtaining smooth deposits has frequently been traced to the presence of impurities such as oxygen or nitrogen which form nitrides or oxides in the deposit. The most pronounced effect of impurities is, however, the embrittlement of refractory metals such as tantalum, titanium, or vanadium by rather small quantities of oxygen, nitrogen, or carbon.

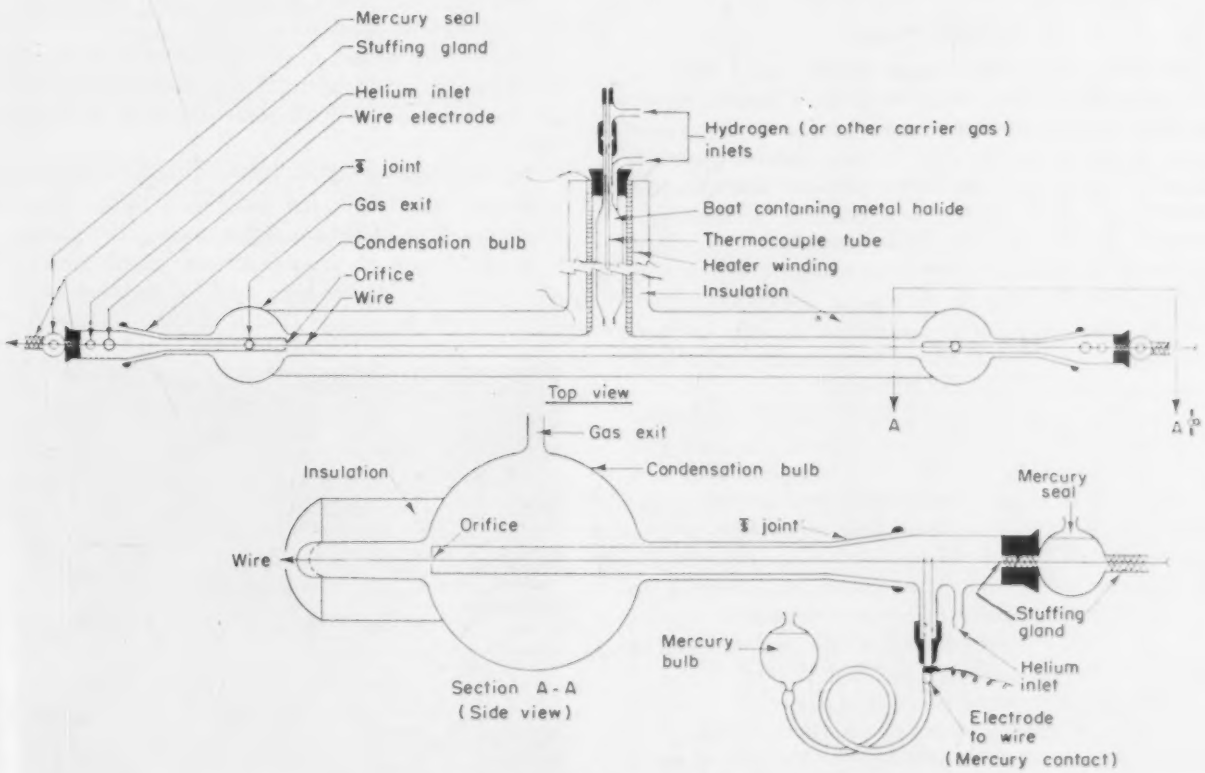

Figure 2. Continuous-flow wire-coating apparatus.

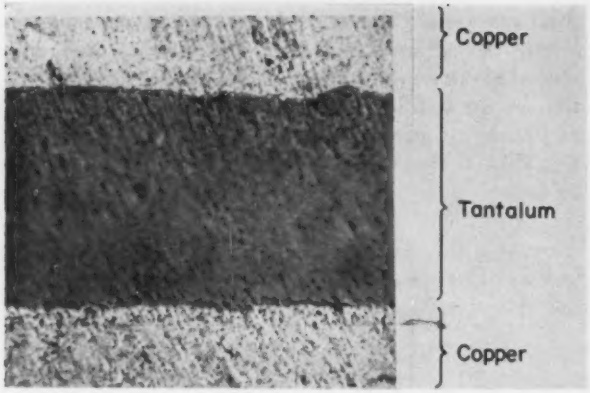

Figure 3. Tantalum on .072" diameter O.F.H.C. copper wire, 15 minutes at 900°C.

The purity of the deposit depends upon the purity of the starting materials. In the hydrogen-reduction process, the desired halide compound should be free of other volatile, reducible halides and of oxyhalides and halogens. The hydrogen used must be free of oxygen, nitrogen, and hydrocarbons if ductile metal deposits are desired.

Rates of Deposition

Deposition rates vary with the material deposited and the process used. Hydrogen reduction of certain metal halides proceeds at 0.0003 to 0.0025 inch per minute, but in some cases, particularly with the thermal-decomposition processes, much lower deposition rates are obtained.

The thicknesses of vapor deposits may be varied within a wide range — from a few millionths of an inch to a quarter of an inch or more. The average deposit runs from 0.001 to 0.01 inch in thickness, depending upon the type of service required of the coating.

Uniformity

Coating uniformity depends chiefly upon the uniformities of specimen temperature and of rate of supply of fresh plating atmosphere to all surfaces of the sample. Nonuniform specimen temperatures produce heavier deposits on the hotter portions, except under conditions where higher temperatures produce premature reaction of the plating atmosphere. Uniform specimen temperatures are most readily obtained with external heating, but at the cost of lower plating efficiency. Internal heating, by induction, will, in most cases, give uniform specimen temperatures, if a judicious coil design has been employed.

A uniform supply rate of fresh plating atmosphere is more difficult to obtain than uniform specimen temperature, especially on stationary samples. With nonturbulent flow at near-atmospheric pressures, the material tends to deposit in pronounced streamlines and on the windward side of objects. Such nonuniformity can be reduced or eliminated by rotating or inverting the specimen during plating or between consecutive plating periods, and by proper baffling of the coating chamber so as to produce turbulent gas flow through it.

Operation at reduced pressure is sometimes useful in improving deposit uniformity, particularly in processes where premature reduction of the plating atmosphere presents a problem.

Another cause of nonuniform coatings is the "edge effect," or treeing whereby deposition occurs faster at sharp corners, edges, and highly curved surfaces. In most cases the excess material deposited at these points is not objectionable, but, if so, it can be easily removed by grinding or machining, or can be avoided by giving the specimen rounded edges and corners.

Efficiency of Vapor-Deposition Reactions

Plating efficiency, as measured by the proportion of material deposited to material supplied as volatilized compound, varies greatly with the plating process and with the conditions used within any one process. The thermal-decomposition-in-vacuo processes are close to 100 per cent efficient. Values of 10 to 80 per cent have been observed in plating metals by hydrogen reduction of the halides.

Products Plated

A wide variety of products and materials has been coated by vapor deposition. Adherent, nonporous deposits of all of the materials listed in Table 1 have been obtained on one or more of the following: copper, nickel, iron, tantalum, molybdenum, tungsten, a variety of alloy steels, graphite, porcelain, quartz, alumina, Pyrex, and carbide compounds. Metals have been coated on nonmetals, and vice versa.

In addition to wire, rod, tubing, and strip, numerous articles such as pyrometer wells, die blocks, nozzles, crucibles, cyclotron and X-ray-tube targets, and magnetron rings have been coated. Most of the work has been carried out as a batch process, but certain of the refractory metals (Cb, Ta, Mo, W) have been coated on iron, copper, and molybdenum wires, ranging from 0.005 to 0.06 inch in diameter and up to 1000 feet in length, in a continuous-flow process.

The vapor-deposition processes have had only limited commercial application to date. A number of patents have been issued on the coating of wires for lamp filaments, but it is doubtful if any extensive commercial use has been made of filaments prepared in this fashion.

The siliconizing of iron in a silicon tetrachloride-hydrogen atmosphere has been used by the Duriron Company, Inc., of Dayton, Ohio, to improve the corrosion resistance of iron. Gaseous chromizing with chromous chloride has been used for the same purpose and has the advantage that a ductile coating is ob-

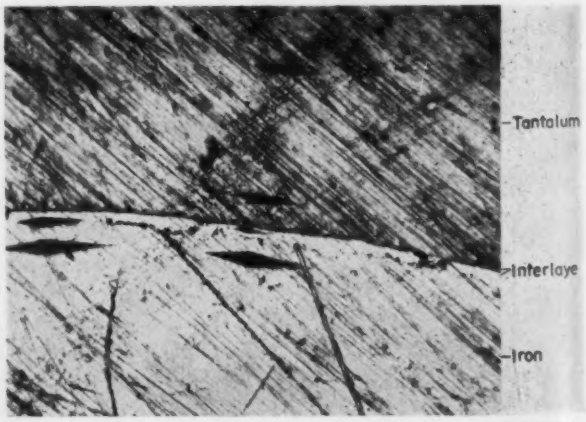

Figure 4. Tantalum on high-purity iron, 30 minutes at 1000°C.

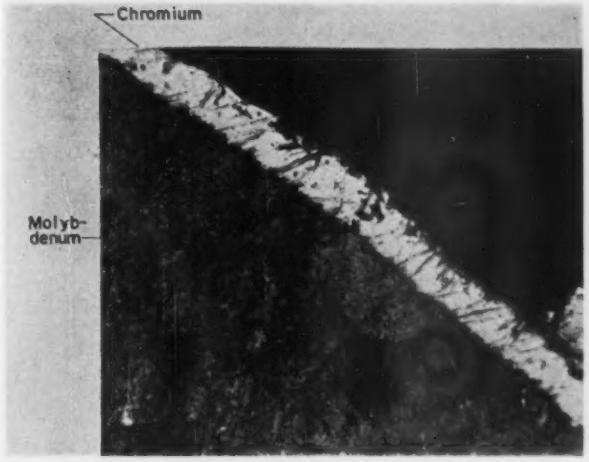

Figure 5. Chromized Molybdenum (pack method). Six hours at 1000°C.

tained. This latter process was developed in Germany before the last war and was used there during the war to extend the supply of scarce, corrosion-resistant materials. Originally known as the BDS process, it has since undergone considerable modification and improvement. It has been reported as being used commercially by the Diffusion Alloys Corporation of New York, by the American Electro Metal Corporation of Yonkers, New York, and by the Metal-Gas Company, Ltd., of England. Commercial chromizing is also probably practiced in Germany and France.

The Fansteel Metallurgical Company of North Chicago, Illinois, produces siliconized-molybdenum articles on a custom basis. The siliconized molybdenum is obtained by treating molybdenum in a $SiCl_4$-H_2 atmosphere to produce a coating of molybdenum disilicide which is noted for its oxidation resistance, but has good all-round corrosion resistance.

Commercial application of the carbonyl-decomposition process for producing metallic coatings, chiefly of nickel, has been made by the Commonwealth Engineering Company, of Dayton, Ohio.

Micrographs of typical coatings of several vapor-deposited metals appear in Figures 3, 4, and 5.

Possible Applications of Vapor-Deposition Processes

1. In many applications, the body of an object is not excessively heated, yet fails through progressive attack initiated at some point in a thin skin at a heated surface. Vapor plating with a thin film of a high-melted material resistant to oxygen, nitrogen, water vapor, etc., would help to avoid this. Specific applications might be: (a) combustion- and exhaust-chamber linings, (b) turbine-blade coatings, (c) valve linings, and (d) coatings for heat exchanger and regenerator elements.

2. Vapor-deposited metallic coatings have been used to prepare (a) vacuum- and photo-tube elements of improved electrical or optical properties; (b) electrically conductive, porous coatings on porous ceramic bodies; (c) metal-coated ceramic particles; (d) tubes and sheets of the refractory metals (prepared by coating a removable core; for example, nonporous, seamless molybdenum, and tungsten furnace tubes have been prepared in this way);[4] (c) massive bodies of hard, refractory, or highly pure materials; (f) corrosion-resistant chemical ware.

Although vapor deposition can give materials of X-ray density and is less subject to coating imperfections than most other coating procedures, careful technique and control are required to obtain the perfect coatings necessary for complete protection. This factor is, of course, the most serious limitation in the use of coatings which are always potentially at least, the "Achilles heel" of a coated metal body.

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ANALYSIS OF CHROMIUM PLATING BATHS

(*Concluded from page* 63)

into the platinum bowl and the filter is washed out with concentrated hydrochloric acid. Now the solution is heated on a water-bath till dry. The precipitate is taken up in distilled water, filtered off, washed and dried. After ignition the SiO_2 found is multiplied by 156.69, giving the amount of Na_2SiF_6 in grams per liter.

Resume

From the results described in the tables given above, it appears that the distillation method gives results with an accuracy which is sufficient in this case. The method is rapid, although some skill is necessary.

It was found that fluoride compounds did not interfere with the estimation of the basic components.

Acknowledgement

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Down by the Old Mill Stream

By W. A. Raymond, *Managing Editor*

The 200 year old mill on the Still River.

IN this modern day of half-mile long plating layouts and 15000 ampere power units it is refreshing to find that here and there throughout the land there still exists an occasional oasis where the arts and craftsmanship once prevalent in the plating field still hold forth, and where an unhurried pace and serene patience are combined in the creation of objects of great beauty and utility.

Such an oasis is the *A. J. Tuck Co.*, in the heart of Connecticut's beautiful rolling countryside at Brookfield, a short distance north of Danbury, the Hat City of the world.

Many things about this ageless plant are unique, but the most unique of all is the source of power for plating — the falling waters of the Still River! Harnessed to a generator through an old time water wheel, through a system of gears and drives, the waterfall provides all the electrical power used to light the plant and in the electroforming processes carried out in the ancient mill — and at a cost that all our modern gadgets could never hope to match! Despite its name, the river flows, Summer or Winter, fast enough to provide all the power needed.

The mill buildings themselves are now nearly 200 years old, and in their long span of life have housed a saw mill, a hat shop, a cotton bedding factory, a shear and scissors manufactory, and now an electroforming and jewelry making industry. Snuggled against the steep rock bank of the Still River ravine, the buildings are in remarkably good shape, considering their entirely wooden structure.

Present owner and operator of the firm is *Alvin Tuck*, for many yeasr a designer for the famous Tiffany

Figure 1. Another view of the mill. The water wheel from which the plating power is obtained is housed in the small shed next to the mill proper.

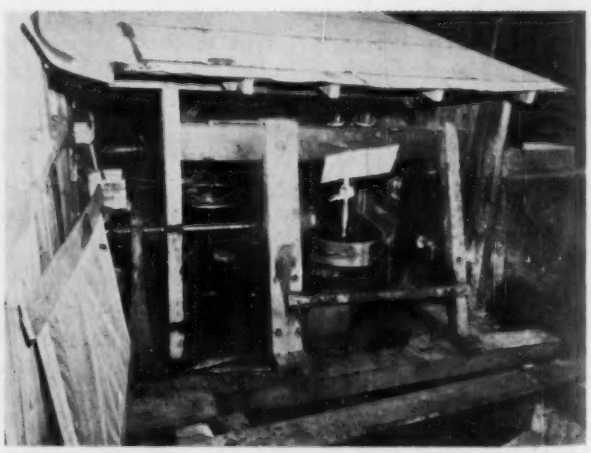

Figure 2. Close-up of the wheel arrangement used to transmit water wheel turning to the generator located in the building to the left.

Figure 3. Some samples of the fine reproductions of famous silver pieces made by the A. J. Tuck Co.

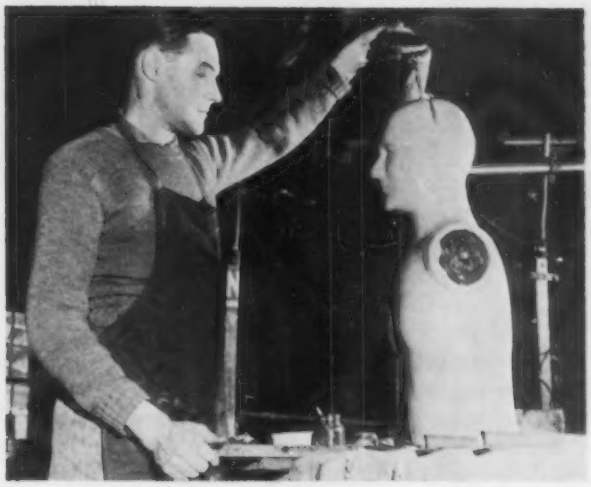

Figure 4. The "Copper Man," one of the modern pieces turned out by electroforming with copper.

firm of New York City. His entire staff consists of his son, *Alvin, Jr.* and daughter *Mary*. Father and daughter are the designers, while Alvin, Jr. carries out the special techniques developed over the many years by his father. The shop is the realization of father Tuck's dream to find a craft which would interest his entire artistic and talented family. He purchased the old mill in 1932, and in the intervening years this family team has turned out an almost unbelievable array of hand made copper costume jewelry, and artistic masterpieces, such as the collection of replicas of Benvenuto Cellini's Arrentine bowls, made especially for the Metropolitan Museum of Art. The exquisite detail of the latter has been commended by the world's foremost art critics, attesting to the skill and craftsmanship of Mr. Tuck. Some of these pieces are shown in the illustrations.

The beautiful copper costume jewelry created by daughter Mary is also highly prized, and is sold only through very exclusive shops in the swanky resorts of the U. S. and abroad. Mr. Tuck and his daughter do all the delicate hand "chasing" of the original molds from which these electroforms are made.

Lest one think that this unique enterprise is of the "fuddy-duddy" era, it should be pointed out that the ancient mill is also a war plant, in the sense that it also turns out a great many electroformed radar parts and other military items.

One of the most interesting jobs ever undertaken by the Tucks was the creation of the "Copper Man" shown in Figure 4. This copper man was required by the Aero-Medical Laboratory of the U. S. Air Force at Wright Field for use in studying thermal problems in the design of flying suits. Five feet 10 inches high, this copper man reproduced the thermal reactions of the human body, allowing the release of Army fliers from many tortuous hours in heat and cold chambers while testing out new equipment. The "Copper Man" was made in 15 sections and wired together. Other methods of making the copper man failed, but electroforming did the job very satisfactorily. All in all, three "brothers" to the original copper man were made.

Keeping the old mill in operation hasn't always been easy. In fact, in order to insure adequate power a new dam was required in 1936. In characteristic fashion the Tuck's built the new dam themselves, and to their own design!

For genial Alvin Tuck and his family the skillful blending of the facilities of the ancient mill and modern electroforming techniques has paid off.

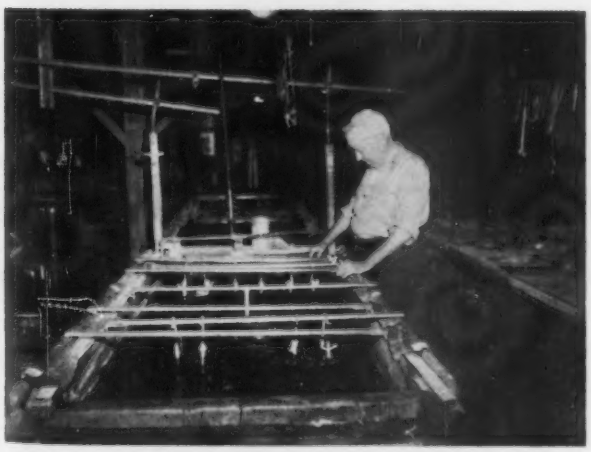

Figure 5. Scene inside the electroforming department, with Mr. Tuck observing the progress of the electroforming operations in the copper sulfate baths.

Figure 6. Alvin Tuck, Sr. and his daughter Mary, who design all the special costume jewelry and art pieces manufactured in the old mill.

Silver Plating

By J. B. Mohler, *Director of Research, Johnson Bronze Co., New Castle, Pa.*

THERE are few plating baths as flexible as the cyanide silver bath. About all that is required is a silver salt dissolved in an excess of alkali cyanide. By keeping the cathode current density sufficiently low an acceptable silver deposit can be obtained. Also, little trouble will be experienced with anode solubility unless the anode current density becomes excessive. Further than this the anode and cathode efficiencies will be close to 100 percent so that the bath will not change rapidly. The drag-in of metal impurities likely to be encountered in the preparatory steps have little effect on the bath. Large amounts of iron, nickel and copper can be tolerated.

Baths other than the cyanide bath have been evaluated experimentally for silver plating but the cyanide bath remains in universal use.

Need for Control

It would be relatively easy to control a silver bath by plating tests alone, merely by testing for limiting current density and adding sufficient silver to maintain an operable current density. Although this could be done, it is not good practice because the method would eventually result in complete loss of control or, at the best, maintenance of operation at an undesired low current density. Silver can be deposited from a simple bath with loose control, but silver plating is an expensive operation and, as such, good control is the most economic procedure.

For most silver plating applications satisfactory results can be obtained by control of free cyanide and silver concentration. Analyses for these two major constituents are easy and of course they are controlled in practically every application. In addition to this the carbonate concentration is usually controlled to a minimum and a maximum value and this also is relatively easy. In fact, if the silver concentration and the cyanide concentration are known then the carbonate can be estimated by making a gravity measurement. This measurement is so rapid that it is well worth while to make an occasional check.

Regardless of the satisfactory results obtained from a simple silver bath, it has been confirmed many times that there are sufficient differences obtained in various formulations to warrant definition of reasonably close limits. With close limits and control over the proper variables the limiting current density can be held sufficiently high to assure continuous quality plating under defined conditions. Under such conditions the plating rate can be set at some maximum value and all work can be routed through the tank at the required current density every day. This is not only a desirable condition but an economic necessity where continuous quality plating or heavy deposits are required.

Development of Silver Baths

Considerable experimental time has been expended on silver plating and many bath formulations have been proposed. Silver baths in modern times have been described by *Frary*[1] and *Promisel* and *Wood*.[2] Potassium salts are generally preferred over sodium salts and additions of nitrate,[3] hydroxide and thiosulfate[4] are now used commercially.

Promisel and *Wood*[2] pointed out that recent investigations have been mostly concerned with modifying the present cyanide bath.

For very thin silver deposits of the order of a few tenths of a mil a simple cyanide bath will suffice. For thin deposits the initial structure will be such that changes in bath formulation will not have an appreciable effect. The first layers of metal that are deposited are usually random and fine grained. However, when more metal is deposited the deposit begins to take on a directional structure that will depend on the bath composition at a given current density.

For deposits of one mil thickness a well controlled simple cyanide bath will also produce good results.

For deposits heavier than one mil careful control becomes essential for consistent results. The effect of changes in bath formulation become very apparent with deposits of 20 to 50 mils. In fact the deposition of thick metal is probably one of the best ways to evaluate the effects of various additives on the bath. A thick deposit will act as a magnification of the structure. Once the structure of the deposit begins to form over the first random layers it will continue its directional growth. Such a heavy deposit will show that deposits from sodium salts tend to be crystalline and that deposits from potassium salts tend to be nodular. In either case the heavy deposit will tend to be rough. However, if thiosulfate is added to the bath a smooth deposit can be obtained with a fine random structure similar to the first few layers deposited from a simple bath in the absence of addition agents.

A bath that has little tendency to form a rough deposit during electrodeposition will be a bath from which the most satisfactory deposits can be obtained consistently. Such a bath may be defined as a quality bath. A quality bath is essential for production of

The Author

sound heavy deposits and it is also one from which good thin deposits can be obtained continuouslly. The deposit from a quality bath will be very finely crystalline even for heavy deposits. Also it will respond to the use of sulfide-containing addition agents, and the use of an addition agent will result in a smooth, semi-bright deposit. Deposits from such a bath will respond more readily to electropolishing.

The control procedures for a quality silver bath are sufficiently simple that they are justified even if the gain in quality is small. In addition to a gain in quality proper, control will either result in continuous operation or at least advance knowledge of the time to reclaim a bath or to make a major adjustment.

Many experimenters have spent considerable time developing silver plating baths, but the real test of a bath has been by performance under continuous control. Continuous use of a bath tests all variables over their entire range, since the bath will be used over the range of all the limits at all combinations. Continuous control of a bath with a detailed log of analyses, appearance of the deposit, and chemical additions will tell the story. Occasional plating range tests will indicate any shift in limiting current density.

A quality silver bath can be made by the use of silver nitrate, potassium cyanide, potassium hydroxide and frequent additions of sodium thiosulfate, as shown in Bath #1.

BATH No. 1

	grams per liter
Silver nitrate	40-50
Free potassium cyanide	30-35
Potassium hydroxide	2-5
Sodium thiosulfate (daily)	.05
Temperature	90-100°F.
Current Density amp./sq. ft.	6
pH	12.0-12.7

Silver nitrate is a convenient source of silver. The bath could just as easily be made using silver cyanide, potassium cyanide and potassium nitrate. The major reason for the use of silver nitrate is that it automatically controls the nitrate concentration. Nitrate is lost from the bath at essentially the same rate as silver since the nitrate is lost by drag-out. Because of practically equivalent electrode efficiencies the silver is also lost from the bath by drag-out.

Silver nitrate is readily soluble in water and is a cleaner salt than silver cyanide. Also it is a salt of excellent purity because it is made by crystallization, whereas silver cyanide is made by precipitation. A precipitated product generally occludes suspended impurities more readily than a crystallized product.

The silver concentration of Bath No. 1 is not critical. If the silver concentration is increased the critical current density will be raised and slightly higher current densities can be used. This slightly higher current density will be obtained at the expense of higher drag-out losses of silver.

The free potassium cyanide is that amount of the total potassium cyanide in excess of two moles required to render the silver soluble. The quality of the deposit will change with the free cyanide concentration and very high or very low quantities are not satisfactory. As the amount of free cyanide is increased the current density at which the anode polarizes excessively is increased. High concentrations of cyanide will increase ease of anode solubility but they will also decrease plating quality and increase the rate of bath decomposition.

Potassium hydroxide will increase bath conductivity and will assure more uniform results with a wide carbonate range. Also, carbonate will be formed in the bath by decomposition of hydroxide rather than by decomposition of the more expensive cyanide.

If potassium hydroxide is not used to make up the bath then some potassium carbonate will be required. In the absence of hydroxide a minimum of 20 grams per liter of potassium carbonate is recommended. If more nitrate is added to the bath, then an initial addition of carbonate will not be required.

Promisel and *Wood*[2] cite Bath No. 2 as a commercial bath.

BATH No. 2

	grams per liter
Silver (as metal)	16-18
Free sodium cyanide	15-22
Sodium carbonate	22 max.
Potassium nitrate	113-150

Bath No. 2 is made up initially without carbonate and it is claimed that at carbonate concentrations above 22 grams per liter maximum brightness is not obtained.

It is well to notice that Bath No. 2 is made up with some sodium salts. This demonstrates that the potassium silver cyanide baths have some tolerance for sodium without loss of quality. Since this is so it is economical to make up the strike bath with sodium cyanide, and also to use sodium thiosulfate as an addition agent. Sodium accumulations in the bath from these two sources by drag-in and direct addition will not be harmful.

BATH No. 3

	grams per liter
Silver (as metal)	30- 40
Free potassium cyanide	35- 45
Potassium carbonate	40-100

Bath No. 3 is a good simple silver cyanide bath. It contains the fundamental chemicals for good bath operation: a sufficient silver concentration to maintain a fair cathode current density, free cyanide to increase conductivity and to allow anode solubility, and carbonate to increase bath conductivity. For thin deposits a cathode current density of 5 amperes per square foot may be used, but for consistent quality of heavier deposits the cathode current density should be decreased to 3 a.s.f. This is a basic bath, and variations may be made on such a bath to alter bath characteristics. If it is desired to operate at higher current densities the silver content and free cyanide may be doubled. In such a case the initial carbonate content may be halved. An increase in bath temperature will also be an aid for higher plating rates.

Brightening Agents

Sodium thiosulfate is a convenient chemical to use as a brightener since it is common, cheap and readily

available. It does not assure maximum brightness but if it is used daily it will assure a semi-bright, smooth, and finely crystalline deposit. If the bath is operated on a 24-hour basis somewhat better results will be obtained by more frequent additions of sodium thiosulfate, but the total quantity added daily should be the same whether or not one or more additions are made per day. If smaller amounts are added they will be less effective. If larger amounts are added they will not increase the effectiveness.

Carbon disulfide may be also used as a brightener. Carbon disulfide brightener is made by saturating a potassium cyanide solution by shaking with carbon disulfide and allowing it to age for several days before use. Additions are made on experience. Bright plating can be obtained but control is difficult. If an insufficient amount of brightener is used it will not be effective. If an excess of brightener is used it will be harmful and it will be necessary to purify the bath by treatment with activated carbon. If the bath is not operating at maximum brightness it can only be determined if there is a deficiency or an excess of brightener by experiment. The additions cannot be made on a schedule, but control is possible by testing of a portion of the bath for effect of further additions.

Operating Conditions

Cyanide silver baths are usually operated at room temperature. Although satisfactory results are obtained, there is a shift in plating range with change in temperature. Therefore it may be necessary to lower the current density as the bath temperature rises. This can be compensated for by increasing the free cyanide content. At higher temperatures more free cyanide is required to maintain a high limiting current density. However, high free cyanide and high temperature both increase bath decomposition, so it is not economical to increase either more than required.

The bath can be maintained at 95 to 100°F. by the use of a small immersion heater and a thermoregulator. This narrow range is not required but is easily held. The wider range obtained by room temperature operation will be such that operation will be less consistent than with temperature control.

If a quality silver bath is operating properly it should be possible to plate continuously at a cathode current density of 6 amperes per square foot. If agitation is used the current density can be increased. The easiest way to do this is by movement of the cathode rod. With a cathode movement of 10 feet per minute the current density may be increased to 15 a.s.f. It is not practical to stir the solution, since it is very difficult to obtain uniform movement throughout the bath. However if the solution can be pumped past a favorable shape in such a way as to have uniform velocity across the cathode surface then the current density may be increased to 75 a.s.f. A quality deposit can be obtained under these conditions and it is likely that the current density is only limited by mechanical difficulties in obtaining high velocities at the cathode surface. The problems encountered in high speed strip plating would probably apply to silver just as they do to tin. Certainly the problems with insoluble particles in the anodes and solution decomposition due to increased contact with air would be common to each.

If anode polarization is a problem in a bath and the anode area cannot be decreased then agitation, increase in temperature and increase in free cyanide all will decrease anode polarization.

Better throwing power is obtained with the dilute baths since the cathode tends to polarize more readily at higher current densities.

The addition of nitrate to bath No. 3 will aid anode corrosion and result in fine-grained semi-bright deposits. Further, addition of hydroxide will increase bath conductivity and make pH control possible. With pH control there will be less difference in the limiting current density of a fresh and an old bath.

With several additions Bath No. 3 becomes Bath No. 1. Changes may also be made in Bath No. 1 to change operating characteristics; however each change in any of the baths is accompanied by an advantage and a disadvantage. A change may be made to overcome a specific trouble but changes from established limits invite new troubles.

Table No. 1 shows the advantages and disadvantages that result on increasing chemicals or conditions of a silver bath. Whether or not a change in the bath is warranted is an economic matter. Changes made merely to lower bath voltage are not economic since the savings in power cost will not offset drag-out loss or bath decomposition. Changes to increase the limiting current density may be essential to cut costs where long plating times are required. Whatever changes are made it is well to set easily controlled narrow limits on the bath composition and conditions to obtain consistent results.

Table No. 1

Effect of Chemical Changes on a Silver Bath

Chemical or Condition Increased	*Advantages*	*Disadvantages*
Silver and Free Cyanide	Increase limiting current density. Lower bath voltage.	Increase drag-out. Decrease throwing power. Increase carbonate formation.
Carbonate	Lower bath voltage.	Shorten bath life.
Nitrate	Lower bath voltage.	Increase nitrate loss by drag-out.
Hydroxide	Lower bath voltage. Decrease cyanide decomposition.	Increase carbonate formation.
Temperature	Increase limiting current density. Lower bath voltage. Decrease polarization.	Increase carbonate formation.
Agitation	Increase limiting current density.	Requires frequent filtering of bath.

Table No. 2 shows the pH, given to the closest 0.1 unit. The pH of a potassium cyanide solution is approximately 10.4 and the pH of a potassium carbonate solution is approximately 11.0. An addition of two grams per liter of potassium hydroxide will raise the pH to approximately 12.0. At this pH the bath is at the lower limit of the range for more consistent performance and still in a range easily controlled by pH. Above a potassium hydroxide concentration of 8 grams per liter the pH does not increase greatly with further addi-

Table No. II
pH of Silver Plating Baths

grams per liter potassium hydroxide	pH glass electrode
0	11.0
1	11.7
2	12.2
3	12.4
4	12.6
5	12.7
6	12.8
7	12.9
8	13.0
9	13.1
10	13.1

tions of potassium hydroxide. It is not desirable to operate with higher concentrations of potassium hydroxide, but if it were it would be more practical to control by titration rather than by pH.

Table No. III
Gravity of Silver Cyanide Baths

Total Salt Concentration Grams per liter	Gravity Degrees Baumé 25°C.
100	8.1
120	9.7
140	11.3
160	12.9
180	14.5
200	16.0
220	17.3
240	18.7
260	20.0
280	21.4
300	22.8

The gravities for various total salt concentrations of silver baths are shown in Table No. 3. These figures include combined cyanide which must be calculated from the analysis for silver. They were taken from a number of baths containing nitrate salts and the gravity will vary somewhat as the ratios of chemicals are changed for a fixed total salt concentration. However, this variation is not great and since the carbonate limits are wide the figures are sufficiently accurate for control.

Plating Range Tests

Figure No. 1 shows a plating range standard for Bath No. 1. This standard was for a slot-type plating range cell using a ¼ slot one inch from a four inch cathode. The total current was 0.42 amperes for a 2½ inch by 4 inch cathode or an average cathode current density of 6 amperes per square foot. The plating shows that the limiting current density is 9 a.s.f. and that the deposit tends to become spongy at a current density of 12 a.s.f. It is well to run a plating range test every time an analysis is made. Any shift in plating range is significant and indicates either that the bath is getting out of control or that it is shifting due to chemical decomposition. It is not practical to try to control a quality silver bath by plating range test alone. On the other hand, such a test is worth the time it takes in order to obtain a record of shift in plating range with bath life.

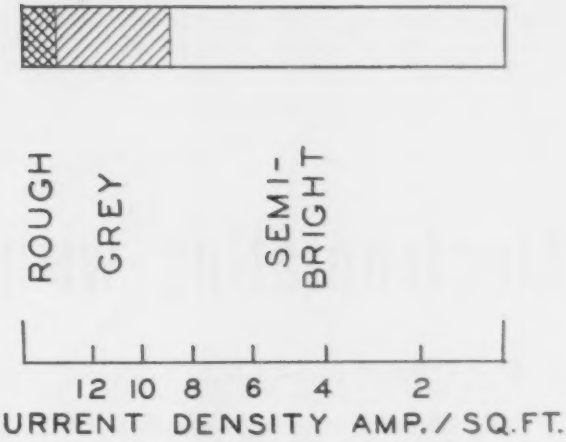

Figure 1. Plating range of a quality silver plating bath.

The plating range test will anticipate trouble and it will indicate the time for major bath changes such as carbonate removal. The plating range test will also show the limiting current density of a simple bath, such as Bath No. 3, to be about 6 amperes per square foot, and by plating range test it can readily be determined how additions to such a bath will raise the limiting current density.

Making Up the Bath

If a silver bath is made up with silver nitrate it is best to add the silver nitrate as a solution to a solution of potassium cyanide. When such an addition is made the silver will precipitate momentarily as silver cyanide and redissolve readily. Such a procedure will avoid caking of salt on the bottom of the tank.

If silver nitrate is not available a nitrate bath can be made from silver cyanide and potassium nitrate.

The nitrate bath made up with cyanide would be made from:

	grams per liter
Silver nitrate	50
Potassium cyanide	88
Potassium hydroxide	5

An equivalent bath can be made from:

	grams per liter
Silver cyanide	40
Potassium cyanide	70
Potassium nitrate	27
Potassium hydroxide	5

In each of these baths the total salt is the same; the silver concentration is 33 grams per liter and the free cyanide is 50 grams per liter.

If hydroxide is used in a silver bath then the carbonate can be precipitated by the use of barium hydroxide. This will precipitate barium carbonate and leave potassium hydroxide. However, for continuous control it will have to be done frequently or else a portion of the bath will have to be treated so that it contains a high concentration of hydroxide to be used as a stock solution.

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3. Wood, *Proc. Am. Electroplaters Soc.* (1937)
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Electroplating with Aluminum

By Nelson F. Murphy, *Research Professor, Virginia Polytechnic Institute, Blacksburg, Va.*

Mr. Murphy received his Ch.E. degree at Univ. of Cincinnati in 1929, and the Ph.D. from Cornell in 1934. He is a member of the A.E.S., and was President of the Syracuse Branch 1944-1946. He taught at Syracuse before coming to Virginia. His practical experience was with General Chemical Co., Atlas Powder Co., Procter and Gamble, and with Bristol Laboratories.

Dr. Murphy is in charge of the research fellowship investigating possibilities of plating with aluminum from various systems established by the Air Research and Development Center at Virginia Tech.

ALUMINUM is one of the lightest and potentially cheapest metals known. It has excellent corrosion resistance, and therefore it has been suggested that aluminum be used as a coating for metals that are more susceptible to corrosion action.

Electrodeposition of aluminum on other metals has been achieved, but there are still many problems which prevent widespread industrial application of the processes developed. Research is still underway to develop a better procedure, one which will permit large scale operation, as well as improve the quality of the coating. This paper will review some of the processes which have been developed, point out their shortcomings, and indicate needs for future research.

Coating with Aluminum

Before considering electrodeposition, it would be well to become acquainted with other processes for applying aluminum coatings to metals.

Calorizing

Calorizing is a trade name for alloying aluminum with steel by diffusion. The depth of penetration of the aluminum-iron alloy ranges from 0.005 to 0.040 inches. This alloy surface usually contains about 25% aluminum. It may be obtained by three methods: retorting, packing and dipping.

An early method of calorizing made use of a revolving retort in which pieces were packed with a mixture of finely divided aluminum, alumina, and a filler such as ammonium chloride. The retort was heated to 1550 to 1700°F. and revolved for four to six hours. This treatment resulted in a brittle surface, which can be eliminated by heat treatment for 12 to 24 hours at 1500 to 1800°F.

In the case of pack calorizing, the pieces are heated longer and the calorizing container is not rotated. This method is used for pieces that would be damaged by tumbling.

Articles to be dip-calorized are thoroughly cleaned with a flux, then dipped in a bath of molten aluminum. Heat treatment results in diffusion of the surface coating into the underlying metal.

Spraying

Articles can be coated with aluminum by spraying the metal against the base metal.

Cladding

Aluminum may be bonded to iron by heating thin sheets of aluminum and iron to about 350°F., and then passing them between rolls. The combined metals are then subjected to a second rolling to give the desired thickness and adherence to the coating. The result is a uniform coating, each metal retaining its own properties. The method combines the strength of the underlying metal with the corrosion resistance of the aluminum.

Painting

So-called aluminum paint, aluminum powder in a varnish, lacquer or paint vehicle, has more the properties of a paint than of a metallic coating.

Thermal Evaporation

Aluminum may be applied as a coating by thermal

evaporation.[17] This results in a thin film which has a structure said to be "essentially fragmentary," i.e., without orderly arrangement of the crystal lattices. Evaporation is accomplished by heating a wire of the metal in a vacuum of about 10^{-4} millimeters of mercury.

SPUTTERING

Metal, vaporized in an electric arc, is attracted to an article to be coated by impressing an electromotive potential across the arc. At vacuum of 1 to 300 microns, the metal will deposit on the cathode as a very thin mirror.

Early Attempts to Electrodeposit Aluminum

There have been many attempts, with some reported success, to electrodeposit aluminum from aqueous solutions.[18,20,29] In all cases the production of aluminum could not be confirmed.[7,32] In some cases,[10,22] other metal deposits were mistaken for aluminum. In 1940, *Wade* and his co-workers[30] pointed out that hydrogen is discharged at the cathode from aqueous solutions at a lower potential than aluminum.

Two teams of investigators[2,28] in 1930 and 1931, failed to obtain aluminum from electrolysis of liquid ammonia solutions of aluminum salts.

Electrodeposition from Organic Solutions

The solubility of aluminum chloride, bromide and iodide in organic solvents encouraged efforts to electrolytically deposit aluminum therefrom. The efforts failed when formamide,[1,26] ethylene glycol,[1] or acetamide,[8] were used as solvents.

Aluminum was obtained from solutions of aluminum halides in xylene,[25] benzene and nitrobenzene,[25] ethanolamine,[8] ethyl bromide,[24] ethyliodide,[15] and tetraethyl ammonium bromide.[16] From pyridine, Russian investigators[25] report aluminum deposits, but Americans[1] and German[21] investigators disagreed with these results.

Meerwein[19] has shown that many weak electrolytes are increased in strength by the formation of complex ions. The existence of conductivity has been attributed to the formation of solute-solvent complexes by other authors.[12,31] Based on this explanation, the more successful methods of electrodeposition of aluminum involve the use of aluminum chloride in organic solvents capable of forming complex ions.

Recent Developments in Electrodepositions from Organic Systems

Keyes and co-workers[16] obtained a patent for the use of a mixture of tetraethyl ammonium bromide and aluminum bromide as electrolyte. The voltage used was 22.6 volts, the current density was 0.44 ampere per sq. in. of cathode surface. The process is said to be suitable for plating steel economizer tubes.

Blue and *Mathers*[1] prepared an electroplating bath by warming 2.5 grams of aluminum foil with a few drops of bromine in a dry Erlenmeyer flask equipped with a reflux condenser. The aluminum bromide thus formed catalyzed the reaction between ethyl bromide and aluminum when ten milliliters of ethyl bromide were added slowly over a period of 15 minutes followed by three 5-milliliter portions of ethyl bromide five minutes apart. The volume of the bath was increased by adding benzene and ethyl bromide alternately in five-milliliter portions to obtain any desired volume. The bath separated into two layers; the bottom layer was the electrolyte, and the benzene layer acted as a protection of the bath from atmospheric moisture.

This bath was electrolyzed at a current density of 0.08 amperes per sq. in. and an adherent deposit of aluminum was obtained on a copper cathode after ten hours. Other similar baths were electrolyzed at current densities of 0.059 to 0.18 ampere per sq. in. at 64 to 95°F.; the highest efficiencies obtained were 81.03 per cent for the anode and 64.40 per cent for the cathode at a current density of 0.059 amperes per sq. in. and at 64°F.

The authors found that aluminum could be plated on platinum, copper, steel or cast iron, but not on aluminum or magnesium cathodes. Moisture was detrimental to the bath and caused evolution of hydrogen bromide gas. Some baths were operated successfully for as long as four months. Other solvents, including toluene, xylene, beta-tetrahydronaphthalene and kerosene, were tried but benzene gave the best results. Several alkyl halides, including ethyl iodide, ethyl chloride, methyl chloride, and dichloroethane, were substituted for ethyl bromide but gave poor results.

Blue and *Mathers* concluded that the bath was best made by dissolving 30 grams of aluminum metal in one milliliter of bromine, 450 milliliters of ethyl bromide, and 250 milliliters of benzene. The bath probably contained ethyl and phenyl derivatives of aluminum bromide dissolved in ethyl bromide, benzene alkyl derivatives, and benzene.

Blue and *Mathers* also claim that aluminum can be electrodeposited from a bath containing 20 grams of aluminum bromide, 20 grams of aluminum chloride, four grams of aluminum metal dissolved in 40 milliliters of ethyl bromide, 80 milliliters of benzene, and 40 milliliters of xylene. At a current density of 0.1 ampere per sq. in. and at 68°F. the cathode efficiency is above 75 per cent and the anode efficiency is about 100 per cent. Hydrobromic acid or hydrochloric acid can be used in place of ethyl bromide but the results are not as good.

Hurley and *Wier*[14] obtained white adherent deposits of aluminum at about 70°F. from a solution prepared by mixing two moles of anhydrous aluminum chloride with one mole of ethyl pyridinium bromide in a dry, oxygen free atmosphere. Addition of benzene (or toluene) formed a second layer which remained on top of the plating solution. Using aluminum anodes, the plating was accomplished at 0.063 ampere per sq. in. and one volt. The quality of the plate was improved by superimposing alternating current on the direct current.

Hurley and *Wier's* process was the subject of further development by *Safranek, Schickner* and *Faust*[27] of the Battelle Memorial Institute in 1950. The process was adapted to the production of complex-shaped wave guides, whose internal surfaces were shiny and smooth. In the course of this investigation it was discovered

that addition of methyl, tert-butyl ether (one per cent by weight) to the bath produced a smoothening effect. Other addition agents were found to be effective, but to a less degree in reducing treeing of the deposit. Some caused high stresses in the plate.

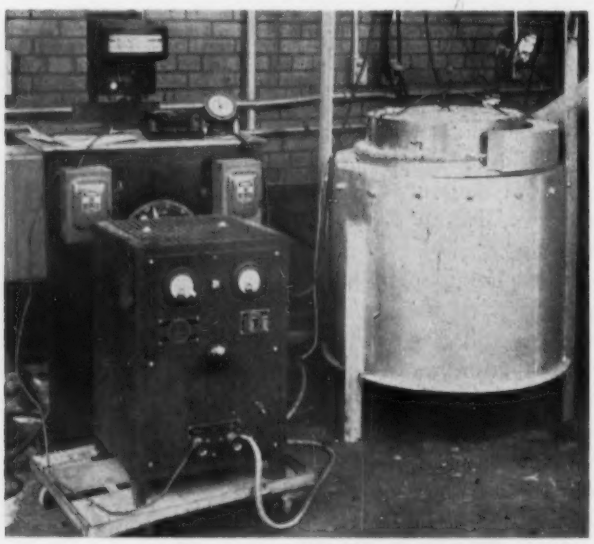
It may be said of the *Wier* process that it is the most successful of those using organic solvents. However ethyl pyridinium bromide is not yet purchasable, and must be prepared from pyridine and ethyl bromide, and the synthesis requires some technique. Furthermore, one cannot readily purchase methyl tert-butyl ether. From an operating standpoint, the bath must be protected and agitated by an inert gas (nitrogen) to prevent deterioration by oxygen and moisture of the air. It is obvious that such a process is not ready for installation in the practical plater's shop.

Developments in Electrodeposition from Inorganic Baths

Bunsen[3] (1854) first obtained solid aluminum by electrolysis of a fused bath of sodium aluminum chloride contained in a partitioned porcelain crucible and using carbon electrodes. *Deville*[7] and *Chatelier*[4] also decomposed sodium aluminum chloride using different crucibles and electrodes.

Wade and co-workers[30] employed a system of 20 mole % sodium chloride, 14 mole % potassium chloride and 66 mole % aluminum chloride in a study of deposition and decomposition potentials of a number of chlorides. Platinum was used as the reference electrode. Aluminum was found to deposit as a smooth surface at a potential of 2.02 volts and at a current density of 0.08 amperes per sq. in. Dendritic aluminum was deposited at a potential of 2.17 volts and the same current density. Samples of these two deposits were easily removed from the cathode by scraping with a dull blade. X-ray examination and comparison with pure aluminum confirmed their identity as the pure metal.

Fink and *Solanki*[9] investigated containers for electrolyzing a mixture of aluminum chloride and sodium chloride. The possibility of obtaining aluminum metal was also investigated. From a system of aluminum-sodium chloride, aluminum was obtained in crystalline form using a nickel crucible as cathode and a carbon rod as anode.



(Photo courtesy of Aluminum Company of America)

Figure 1. Cell for electroplating with aluminum.

Plotnikov et als[25] claim to have produced a satisfactory surface of aluminum on copper from a bath containing aluminum chloride and sodium chloride in a two to one ratio at 428 to 482°F. Cathode current density was 0.065 ampere per sq. in.

The laboratories of the *Aluminum Company of America* have been investigating a process of electroplating metals with aluminum.[5] The bath composition (for steel) is recommended as 75 weight per cent aluminum chloride, 20 weight per cent sodium chloride, 5 weight per cent lithium chloride. Other compositions are recommended for plating on copper or on aluminum alloys. The temperature of the bath is controlled at 338 to 356°F. Impurities are removed by plating on dummies until a trial specimen, plated at 25-30 amperes per sq. ft. for 15 to 30 minutes is satisfactory.

Articles to be plated must be very clean. They are preheated before being immersed in the bath to prevent coating the specimen with frozen salt. Cell voltages average approximately 0.5 volts per inch of anode-cathode spacing at 15 amperes per sq. ft. current density. Slight agitation is desirable, but the sludge which settles in the bath must not be disturbed. With agitation, C.D.S. up to 150 a.s.f. may be employed.

The bath has a rather poor throwing power, so auxiliary anodes are required. The anodes are 2S aluminum, but 7A aluminum is used if a plate of high purity is desired.

*It is necessary to add aluminum chloride at frequent intervals in order to replace losses from the bath by fuming and hydrolysis. Fuming from the bath is rather severe when the cover is lifted and requires adequate ventilation. The amount of fuming and consequently the amount of make-up aluminum chloride which must be added depends upon the bath temperature, since fuming is more severe at elevated temperature and the relative humidity of the atmosphere.

A cell similar to the one shown in Figure 1 was operated at the laboratories for a period of several months with no serious operational difficulties. The aluminum chloride fumes generated by the cell were collected by passing through a Rotoclone air washer. Since the fumes generate a weak hydrochloric acid solution in the water of the Rotoclone, the concentration of acid was kept low by providing more water than usual.

The apparent resistivity of the bath may be used as a criterion for scheduling addition of aluminum chloride. It has been found that the apparent resistivity of the bath increases as aluminum chloride is depleted. Once a voltage-current relationship for any given set of conditions with the original bath composition has been found, it should be maintained by periodic addition of aluminum chloride.

Deposition of aluminum from an aluminum chloride-sodium chloride bath will proceed at a rate of approximately 0.3 gms. per ampere hour or 0.0004″ thickness in 30 minutes at 18 amps./ft.^{2}. A cathode current efficiency of about 80% is obtained. If agitation is em-

*This material contributed by Mr. F. R. Collins, Alum. Research Labs., Alum. Co. of America, New Kensington, Pa.

ployed, a like amount of metal can be deposited in 5 minutes, but current efficiency will be somewhat lower.

A photomicrograph of the aluminum-steel interface is shown in Figure 2. It can be seen that the coating is uniform and contains no continuous pores. There is no interfacial layer of iron aluminum alloy such as occurs on hot dip coated articles.

A recent development for electrodeposition of aluminum has been reported by *Couch* and *Brenner*[6] of the *National Bureau of Standards*. Ductile deposits of aluminum were obtained from an ethereal solution of aluminum chloride, to which lithium, or lithium-aluminum hydride had been added. Deposits 0.02 to 0.035 inches thick were obtained at a rate of 0.001 to 0.002 inches per hour. The bath is said to be not highly sensitive to moisture, but will have a longer life if protected from air.

Conclusion

There are still many unsolved problems. The bath must be protected from the atmosphere and fume disposal must be provided. The low molecular weight, high resistance of the bath and the low optimum current density, all result in slow electrodeposition. There have been no wholly satisfactory brighteners discovered, as yet. Finally, the operating range of conditions and compositions is very narrow, requiring close supervision.

Very little has been written regarding the properties of aluminum electrodeposits. Ductile, adherent, impervious plates have been obtained when the bath was subject to strict control of conditions and composition. The coating imparts excellent resistance to high temperature corrosion, and this is probably its most important, future function.

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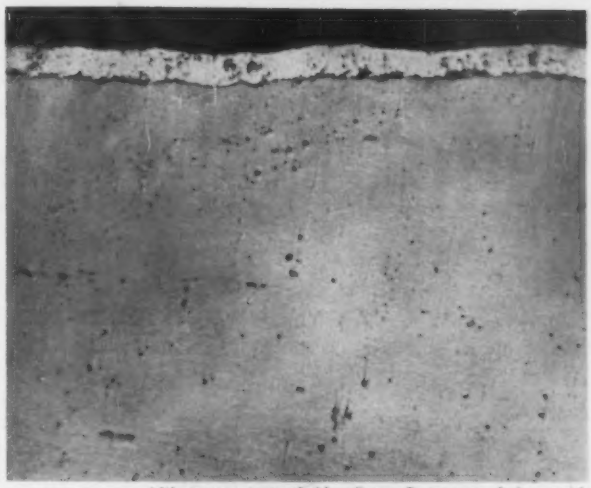

(*Photo courtesy of Aluminum Company of America*)

Figure 2. Photomicrograph of aluminum-steel inter face at 500x shows uniform coating.

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Outstanding Technical Sessions To Feature June A. E. S. Meeting

From the fine quality of its excellent educational program to the fun and frolics planned for entertaining its guests, Chicago Branch, as host to the Supreme Society in '52, takes inspiration from its great city to again do big things in a big way.

In addition to the traditional program, there will be an experiment with dual technical sessions. On Monday afternoon two sessions will be held simultaneously in two different locations. If reaction is favorable, it will be continued in subsequent conventions.

Men of outstanding national reputation and ability have been chosen to carry out the speaking assignments at the Educational Sessions. The program will open Monday, June 16th, at 9:00 A.M., with a speaker of national stature. Following this the educational sessions will get under way. Morning sessions will begin at 9:00 A.M. and afternoon sessions will begin at 2:00 P.M. Only one afternoon session has been planned thus far. This will be the dual session planned for Monday afternoon. Papers to be presented this year are of timely interest and will include:

Heavy Rhodium Plating.

Developments in Filters and Their Use—Theory and Practice.

P. R. Copper Used in Electroforming.

Anodizing and Hard Coating of Aluminum.

New Developments in Plastics and Their Use in Plating.

Use of Tracer Techniques in Solving Plating Problems.

Military Applications of Electropolishing.

Ion Exchange Resins Used for Recovery and Waste Disposal.

Two Symposiums are scheduled. The first will be on "*Materials of Construction.*" This will be handled by a panel consisting of *Fred Brune*, Chrysler Corp.; *Dr. Russell Harr*, Western Electric Company; *W. H. Prine*, International Nickel Co. The subjects will be "*Construction of Waste Disposal Plant*", "*Plating Department of Western's New Indianapolis Plant.*" and "*The Corrosion Problem and Materials to Combat it.*"

The second Symposium will be "*Instrumentation and Auxiliary Equipment.*" This will be handled by a panel consisting of *Frank Savage*, *Dr. A. K. Graham* and a third speaker.

The first exhibitor to contract for space was the Belke Co. whose booth is shown above.

The Thursday morning session will be devoted to reports from the Research Committee. The Thursday afternoon session will be devoted to the annual business meeting.

Because of a wise choice of subjects and speakers, attendance of the technical and educational sessions will be a stimulating experience from which to carry home many ideas that can be put to practical and profitable use.

The response to requests for exhibits for the Third Industrial Finishing Exposition indicates that this phase of operations also will set a new record this year. Chicago is not boasting when it claims that the '52 Convention will be the greatest in the history of the Society.

Convention committee polishes up plans at recent meeting. (L.-R.) Standing—Dr. Monaweck, Harold Weisner, Ralph Wysong, Harry Hansen, Bill Geissman, Elmer Olson, Lew Glassner. (Seated) Rudy Hazucha, Paul Glab, Ray Ledford, Clyde Kelly (chairman) Mrs. Longfield, Cleve Nixon, H. A. Gilbertson, Joe Andrus.

Utah General Depot Re-Finishing Plant

By **Beth Walker,** *Bountiful, Utah.*

WHEN the government approved the installation of an electroplating and re-tinning plant at the *Utah General Depot*, Ogden, Utah, last year, it increased service to units of the rapidly expanding armed forces in the western half of the U. S. and at the same time made possible the saving of thousands of dollars of tax money annually.

There are only two plants of this type in the United States, both operated by the Quartermaster Corps: One here at Utah General Depot, and the other located at the Jeffersonville Quartermaster Depot, Jeffersonville, Indiana. The Utah plant serves the western half of the United States, Alaska and the Pacific areas and meets a great need in this area. With the build-up of the armed forces of the nation, quick service in every branch is a necessity.

"Military operations are costly enough in wartime or in peacetime. We are making it our job to see that our part of the operation is no more costly than is absolutely necessary," says *Col. F. C. Holbrook*, commanding officer at Utah General Depot at Ogden.

Operation of this plant will save the government money in lower processing costs, reduced shipping expense, and costly production delays. If items were "sent out" for commercial processing, as much as thirty days would be needed to put out bid calls and receive and examine returned bids. Then after contracts were let, there would be the additional expense of shipping the items to the contractor and return to the Depot. Meanwhile, production would be at a standstill until the completed items were returned, inspected, and ready for final assembly or packing.

Although present work is limited to small items such as canteen cup handles, food dippers, and mess equipment of the smaller variety, larger pieces such as refrigerator and stove "plated" trimmings, refrigerator racks, and kitchen mixing bowls and pans of all sizes are scheduled for future processing. These are not "war wearies" of the Korean conflict, for little, if any, Korean equipment has been returned; only army equipment which is returned from the posts, camps and stations of the western states, Alaska and the Pacific will be processed here. They are stocks left from World War II which may have accumulated rust or corrosion in storage or been "surface scratched" by usage since the end of hostilities, and are unusable. They are made as good as new by the refinishing given them here.

The efficient and orderly process of re-tinning or plating these items can best be explained by listing the various steps in the zinc and cadmium plating cycle:

1. Degreasing and racking.
2. Steel parts are cleaned anodically in acid, and non-ferrous parts receive a cathodic acid treatment.
3. A rinse is given all parts in cold running water.
4. Parts are given an acid dip for further cleaning.
5. Another cold rinse.
6. Cyanide dip — a final chemical cleaning and stripping process.
7. Cold rinse.
8. Zinc plating (or cadmium) in automatic plating barrels.
9. Cold rinse.
10. Bright dip in nitric acid or chromic acid.
11. Cold rinse.
12. Hot rinse to insure the articles are freed from acid.
13. Blow-off, or centrifuge dry.

The refinishing of refrigerator racks and trimmings is as important as the refinishing of mess gear and kitchen utensils. Refrigerators, perhaps, just like the one in your kitchen, are set-up in field hospitals and first aid stations near the battle areas and in dispensaries of camps in the zone of the interior. Plasma, blood and medicines vital in treating the sick and wounded are kept ready for use in them. Any scratch or nick in the finish of the refrigerator could become a germ breeding spot; a smooth unmarred surface is a "must."

The backlog of items processed by the Utah General Depot plant are interior returns from the western half of the U. S., returns from Pacific areas coming in through west coast ports, with a small amount coming in through New Orleans.

Four master re-plating technicians were brought in from out of state areas to form the nucleus of the plant work force. This was necessary because of the shortage of skilled technicians with the required experience, due to the limited facilities of most plants in this area. This initial work force will be augmented by unskilled

Figure 1. General view of the new refinishing plant. Clean and well lighted, it affords good working conditions and promotes efficiency.

Figure 2. Vapor degreasing is widely used as a preliminary cleaning method.

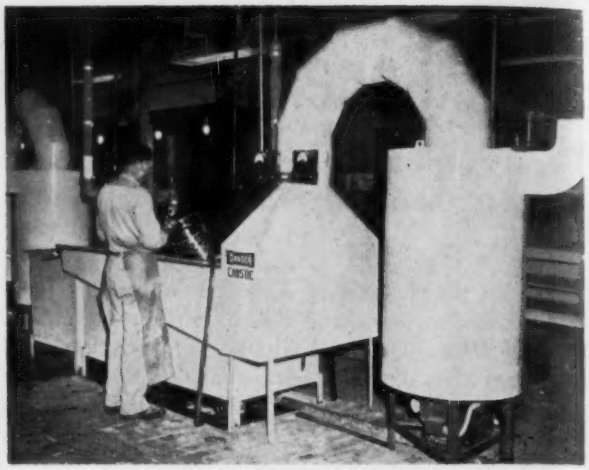


Figure 3. This alkaline cleaning tank is fitted with exhaust equipment to minimize worker discomfort around these irritating fumes.

Figure 4. Barrelling is used to remove rust and provide good surface finish on parts to be plated.

Figure 5. Loading one of the zinc plating barrels with canteen cup handles.

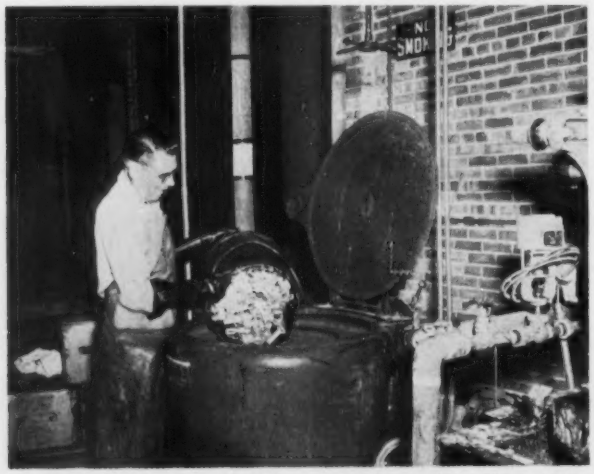


Figure 6. Parts are dried in this centrifugal machine after plating and bright dipping to provide a stain-free finish.

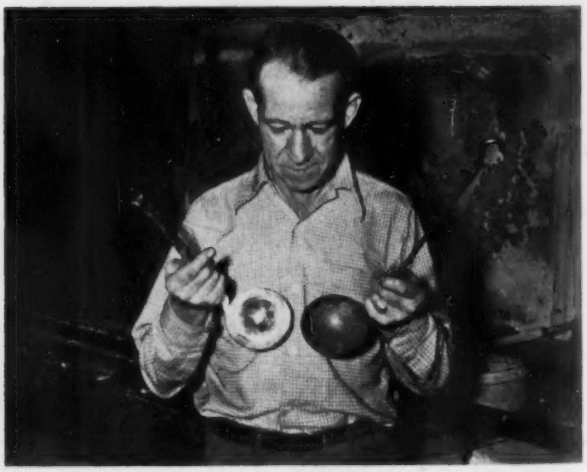
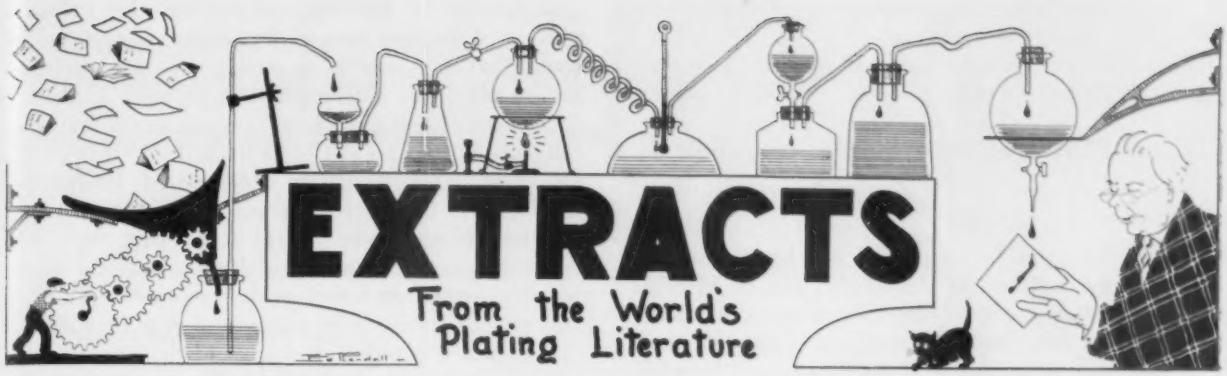


Figure 7. John F. Davis, foreman, exhibits before and after results on a dipper refinished at the Utah Depot.

labor of this area who will learn the trade by the apprentice system.

There are, as yet, no production figures available. However, test runs on small quantities prove that the plant is a money-saver. Officials here believe that a six-month figure will more than justify the installation cost of the plant.

The Utah General Depot was officially activated on September 15, 1941, and has handled a staggering amount of supplies since. In May of 1945 more than eight thousand freight car loads of supplies were handled. This refinishing plant adds another huge mission to the work already being performed by the Quartermaster supply section of the Depot.



German Electroplating Standards

Reported in *Metalloberflaeche*, vol. 5, No. 7, p. B. 107.

At Stuttgart in Germany during May 1951 a meeting took place of the German sub-committee D5 (covering Corrosion and Corrosion Protection) of the German Material Testing Industrial Standards Group (Fachnormenausschusses Materialpruefung—FNM) for the purpose of discussing and bringing up to date Standards for Electroplated Deposits.

An important proposal by the German concerns *Siemens and Halske* and *Siemens Schuckert* resulted in the formulation of a comprehensive Standard Specification for service primarily to the engineering designer and manufacturer employing electroplated coatings. In this Specification is embodied a tabular assemblage of all Standardized Coating thicknesses and in addition the general requirements for all electroplated coatings, while it is also intended in the final specification to include the characteristics of individual electroplated coatings as previously given in separate Standard Sheets.

The Standard Specifications evolved will provisionally have the following numbers and titles:

DIN 50960: Corrosion Protection. Electroplated Coatings. Coating thicknesses and general requirements.

DIN 50961: Corrosion Protection. Electroplated Zinc Coatings on Steel.

DIN 50962: Corrosion Protection. Plated Cadmium Coatings on Steel.

DIN 50963. Corrosion Protection. Plated chromium and nickel coatings on steel.

DIN 50964. Corrosion Protection. Plated chromium and nickel coatings on zinc and zinc alloys.

DIN 50950: Testing Electroplated Coatings. Microscopic Determination of coating thickness.

DIN 50951: Testing electroplated coatings. Specifications for determination of the coating thickness.

Electroplating of High-grade Zinc Alloys containing Aluminum with Copper, Brass and Nickel

K. Loehberg and H. Nann in *Metalloberflaeche*," 1951 (3), pp. B161/165.

A compilation of modern German practice of copper-nickel plating high grade die-casting zinc alloys containing 4-5 per cent of aluminum, up to 0.2 per cent copper and 0.5-1 per cent tin. In concluding their paper the authors recommend the following practice:

1. Degreasing with organic solvents (dip-cleaning in triethylen chloride or vapor-cleaning with triethylen chloride).

2. Short electrolytic degreasing in trisodium phosphate solution (solutions of caustic soda, sodium carbonate, sodium meta-silicate and sodium cyanate attack the surfaces, while sodium meta-silicate tends to form invisible silicate films soluble only in a corrosive 1 per cent solution of hydrofluosilicic acid). Best conditions of tri-sodium phosphate electrolyte: 5 oz./gal., pH Value = abt. 10, Temperature of bath:—167-175° Fahr., Voltage:—8-10 V. Duration: 10-20 seconds.

3. Rinsing first in cold, then in hot water.

4. Dipping in hydrochloric acid, (2-3 per cent HCl, 5 seconds, i.e. until generation of lively gas formation.

5. Copper plating in the following optimum electrolyte:—

Cuprocyanide ($Cu_2(CN)_2$	2.7 oz./gal.
corresponding to metallic Cu	2 oz./gal.
Sodium cyanide (NaCN)	4.3 oz./gal.
Potassium sodium tartrate ($KNaC_4H_4O_6$)	6.8 oz./gal.
Current density	25 amp./sq. ft.
Current density (continuous pant work	20 amp./sq. ft.
Current efficiency	50-70%
Temperature of electrolyte	120-130° Cent.
Time required for minimum thickness of plating (0.0008")	45 minutes

Result: Flesh-colored, silky, easily polished deposit, but rather soft and rapidly thinned at corners, etc. by use of too large or hard (coarse) buffs.

6. Short dip in 5-10 per cent sulphuric acid solution.

7. Polished copper plating must be electrolytically degrgeased before nickel plating.

8. Nickel plating with well known solutions to produce either:

a) heavy plating requiring considerable polishing unless applied to polished surfaces,

b) bright nickel plating on polished surfaces requiring no polishing.

c) bright nickel plating able to produce ex-

tremely bright platings even on non-polished matte copper platings.

Total minimum thickness of combined copper-nickel plating 0.025 mm (0.0010″).

Zinc Plating at High Current Densities

N. P. Dijew: *Journal of Applied Chemistry* (Russian), XXII, p. 361/366.

Theoretical calculations carried out by the author indicated that satisfactory zinc plating can be effected with much higher current densities than is practiced at the present time. He determined by experiment that with zinc concentrations of 4 to 13 oz./gal. in acid electrolyte current densities of 200 to 600 amp./sq. ft. yield satisfactory results. While under many practical conditions most uniform deposits are obtained with low zinc concentrations (4 oz./gal.) and comparatively low current densities, it is advantageous in many other instances to accept a somewhat lesser quality of the deposits under certain practical conditions where first qualities do not seem to be indicated and to operate with high current densities such as 400 amp./sq. ft. Under the operating conditions studied by the author the quality of the plating and the current efficiency is much improved by an addition of 0.15 to 0.25 gr./lt. (0.02-0.03 oz./gal.) of glue. The concentration of glue is of considerable importance. Best qualities of plating at high current densities were obtained with a circulation of the electrolyte corresponding to two changes/hour. The voltage at high current densities (500 amp./sq. ft.) is considerably reduced by increasing the temperature of the electrolyte, the current consumption corresponding to that of galvanizing operations at the customary low current densities.

Influence of Organic Additions on the Structure of Cathode Lead Obtained from Acetic Acid Electrolytes

M. Perec in "*Publications of the (Polish) Main Institute of Metallurgy in Crakow.*"

The lead electrolytes, such as hydrofluoboric acid, hydrofluorsilicic acid, etc. commonly used for the refining of work lead are expensive, difficultly obtainable (in Poland, etc.) and require complicated preparations. Acetic acid solution, on the other hand, are cheap, easily obtainable everywhere and require but simple preparatory operations. The trouble is that in spite of their various more or less important advantages they have not yet been introduced in industrial electrolytical lead refining, since it proved very difficult to find suitable additions able to eliminate the various disadvantages of earlier acetic acid lead electrolytes such as coarse crystallinity, porosity and faulty adhesion to the mother cathodes. There has been no lack of research work to eliminate these difficulties. Pfanhauser called attention to the fact years ago that the addition of a number of colloids, while improving some conditions, could not solve the problems as a whole. The author carried out considerable research and experimental work toward the development of a satisfactory acetic acid electrolyte by the addition of suitable organic compounds.

He studied the influence of glues, gelatine, diphenylamine, phenols and beta-naphtol on the reduction process of the lead ions in acetic acid electrolytes. He found that the dissolved organic compounds diphenylamine, phenol or betal-naphtol in presence of the colloids gelatine or glue exert a pronounced arresting influence on the growth of cathodic lead crystals, this influence increasing in the order stated. Pronounced displacement of polarization was observed only if beta-naphtol and glue were present at the same time. At a constant concentration of the glue contents the degree of polarization increases with the concentration of beta-naphtol, while if the concentration of beta-naphtol is maintained constant, a change of the concentration of glue within a range of 0.5 to 10 gr./l. remains without influence.

Structural and chemical analyses indicated that a curve of the current capacity i(E) as governed by the current density A/cm^2 represents a measure of the description of the organic compounds.

The investigations conducted by Perec indicated that the following electrolytic composition may attain considerable practical importance.

Total Solution	1 liter
Lead (in form of lead acetate)	120 gr.
Acetic acid	20 gr.
Beta-naphtol	4 gr.
Blue (carpenter's glue)	2 gr.
Temperature of electrolyte	20-25° Cent.
Current density	1-1.5 A/dm^2 (10-15 Amp./sq. ft.)

Staining of Silver Plating

Dr. Walter Burkart in *Metalloberflache*, 1951 (3) pp. 65/66.

Frequent cases of staining of silver plating have the appearance of small dull white spots of pinhead to pea size appearing three to fourteen days after plating, or later. They usually can be removed without difficulty by wiping with a cloth or buffing.

Investigations carried out by Dr. Burkart proved that these stains appear only on silver platings over brasses or nickel brasses (German silver alloys) containing considerable percentages of zinc, and that almost invariably the center of the stains contains exceedingly fine pores practically invisible even under a microscope. These pores admit atmospheric oxygen which attacks the metal directly bnneath the pores, causing a slight amount of zinc oxide to creep through the opening and to spread over the surrounding area until all of the available zinc directly beneath the pores is removed. The larger the spot, the larger the stain, since staining is discontinued as soon as no more surface zinc is available. The silver itself is not influenced in any way, and the zinc oxide film is easily removed without, as a rule, making its reappearance. It has been found that if this phenomenon appears suddenly after a long period of plating the same group of alloys the trouble is usually due to an increase of the zinc contents of the alloys. Antidotes are:—1) More intensive polishing of the base surfaces, 2) Increase of thickness of the silver plating. The usual thickness is 10μ to 20μ, which is not sufficient guarantee against porosity. 40μ usually is satisfactory, but this depends on economic considerations.

Shop Problems

METAL FINISHING publishes, each month, a portion of the inquiries answered as a service to subscribers. If any reader disagrees with the answers or knows of better or more information on the problem discussed, the information will be gratefully received and the sender's name will be kept confidential, if desired.

Partial Area Plating

Question: We have the job of plating the outside and bottom surfaces of a pot-shaped device with silver. No plating is wanted on an area approx. 1" down from the top edge on the outside, nor is any plating wanted on the inside at all. We have been doing this by partially immersing the parts in the plating bath, but it is a nuisance maintaining the solution level so that the plating will always cover just the exact bottom and side area necessary. Can you think of a better way to do this type of work?

W. A. J.

Answer: Your present method will work more satisfactorily if you take care to replace each part removed from the tank immediately with a new part to be plated. If the parts occupy a relatively large volume in relation to the total tank volume, there will be serious fluctuations in the solution level each time parts are removed. The trick is in maintaining a constant number of parts in the tank at all times. The small amount of solution lost through evaporation or dragout in this case should not cause any difficulty. Another suggestion would be to use an adjustable spline on the racks, whereby the depth of immersion of the parts can be controlled regardless of the solution level. Automatic level controls are not usually sensitive enough in cases like this. Of course, for the very accurate control of the plating line it will be necessary to use some sort of stopoff. Another method would be to operate the tank as a batch process, loading all the pieces at once, adjusting levels, then plating. For most plating shops this method may not be practical. If cathode rod agitation or solution agitation is used, then the only sure way of maintaining an accurate plating line is by using masking devices.

Making a Salt Spray Tester

Question: We would like to build a box for salt spray testing, and if possible would like to know where specifications for this may be obtained. We would like our box to conform to whatever standards there may be for such devices.

T. S. T.

Answer: A.S.T.M. Specifications B117-49T gives details on the construction and specifications for a salt spray (fog) testing device, as well as on operating instructions. Copies of this specification may be obtained from the American Society for Testing Materials, 1916 Race St., Phila. 3, Pa. (25 cents).

A number of firms sell this equipment ready for use, requiring only a tie-in to the electrical power line. Names of these firms are being sent to you.

Blistered Brass Plating

Question: We are sending you some samples of brass plating on cast iron and steel hardware parts. We have been operating our solutions as per standard practice under the direction of the same foreman for the past 50 years and have never encountered this trouble before. We have tried all the angles we know but without success, and would appreciate any information or help you could give us.

H. H. A.

Answer: In the first place, if there is anything "standard" about brass plating practice this department has never discovered it in its many years in the field! In the second place, if you have been brass plating cast iron for 50 years without ever having had blistering troubles, then this department should be taking lessons from you, not giving out advice!

Seriously, however, the fact that the blistering occurs on both the cold-rolled steel parts as well as on the cast iron pieces is pretty good evidence that surface porosity is not the main factor causing the trouble. It therefore points to improper cleaning (where we hope the same solutions have not been used for 50 years). Without knowing the details of the cleaning procedure it is impossible to give specific information. Too long a delay between the acid dip, rinse, and plating steps often causes this type of trouble. Storing the parts in a weak cyanide bath will help in this case.

Determining Chromic Acid in Copper Baths

Question: Could you send us the details for a qualitative method for determining the amount of chromic acid contamination in a copper cyanide plating bath? We believe diphenylcarbazide can be used, but do not have all the details.

S. D. A.

Answer: A method for analyzing cyanide copper solutions for chromic acid is given in A.E.S. Research Report No. 16, "*Determination of Impurities in Plating Solutions.*" This is available from the A.E.S. headquarters, 445 Broad St., Newark, N. J., at $1.00 per copy.

The emphasis in this booklet is on quantitative methods, using photocolorimeters for measurement, but you could shorten the procedure for routine tests by substituting a visual color comparison in Nessler tubes.

Calculating P-R Plating Thicknesses

Question: We are a little confused by the calculations involved in figuring the amount of plating obtained when using periodic-reverse current

techniques. Can you tell us how much longer we will have to leave a part in the tank to obtain a specified thickness when we use a 20-second plate—5-second deplate cycle?

N. J. S.

Answer: The general formula for P-R calculations is

$$\frac{\text{Plating time} - \text{Deplating time}}{\text{Plating time} + \text{Deplating time}} \times 100 = \text{P-R cycle efficiency in \%}$$

With your figures this becomes

$$\frac{20 - 5}{20 + 5} \times 100 = \text{\% Efficiency}$$

$$\frac{15}{25} \times 100 = 60\% \text{ Efficiency}$$

Therefore your net plating thickness is only 60% of what you would get using the same C.D. for 25 seconds of straight plating. You will thus have to increase your time by the factor $\frac{100}{60}$, or to a total time of 41.7 seconds.

Zinc Plating vs. Galvanizing

Question: We would like to have your opinion on the merits of zinc plating (.001") and dichromate conversion coating as compared to hot-dip galvanizing as a base for painting where the metal to be protected is steel. Service conditions are average indoor.

E. P. H.

Answer: Considered strictly from the point of view of a base for subsequent painting, the zinc plate-chromate coating would be better than the plain galvanized coating, and the thickness cited should be adequate for average indoor exposures.

However, the protection offered to steel by zinc coatings of good quality is a function of the thickness of the coating, whether it be plated or hot-dipped. Since hot-dipped coatings are usually thicker than plated coatings, it follows that the hot-dipped coatings would be superior as a protective for the steel base metal, but would not be receptive to an adherent and durable paint coating. If the utmost corrosion resistance is needed, and the final coat must be an organic type finish, you can combine the heavy hot-dipped zinc coating with a chromating treatment. For average indoor work, the .001" of zinc plate plus chromate plus paint should be perfectly satisfactory, however.

Heavy Gold Plating of Instruments

Question: We have been given the job of putting a gold plated finish on a scientific instrument where the plated surface will come in contact with a variety of corrosive gasses. This is an experimental job, and no specifications exist nor is there any prior experience to draw upon. We would appreciate any suggestions you could make as to what thickness of gold we should put on.

T. I.

Answer: This is really shooting in the dark, but as long as we can't be criticized for overdoing it, our suggestion would be to plate about .0003-.0005" of gold on the parts. A lot depends on how much can be spent on the part in relation to the cost or dependability required of the instrument. If your customer doesn't fall off his chair when you quote your price for this amount of gold we have probably made a good guess!

Removing Copper from Cadmium Bath

Question: We have built up a substantial amount of copper contamination in our cadmium solution and would like to know what we can do to get rid of it.

B. L. F.

Answer: The simplest method would be by low current density electrolytic treatment. A.C.D. of 3-4 a.s.f. would be sufficient to remove the copper, as well as any lead or tin in the bath. Allowing the free cyanide to drop to a very low value will also precipitate copper compounds. Powdered cadmium metal stirred into the bath will also remove the copper by chemical displacement. After either of the two latter treatments it will be necessary to filter the bath thoroughly to avoid rough plating.

Small amounts of copper (up to about 3 gm./l.) are not considered harmful in cadmium baths, unless bright dips are used subsequently.

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Recently Granted Patents
in the Metal Finishing Field

Patents

Periodic Reverse Plating

U. S. Patent 2,575,712. *G. W. Jernstedt, assignor to Westinghouse Electric Corp.*

In the process of electrodepositing a metal selected from the group consisting of copper, brass, silver and zinc upon a base member from an aqueous cyanide electrolyte suitable for the electrodeposition of the metal, the steps comprising applying to the base member the aqueous electrolyte containing cyanide, passing an electrical current through the base member and electrolyte to render the base member cathodic for a period of time of from 2 to 40 seconds to electrodeposit metal upon the base member, discharging in about ¼ of a second through the base member and electrolyte a condenser charged to a potential of at least 30 volts and not in excess of 1,000 volts, the condenser having a sufficient capacity to discharge from about 0.003 to 10 coulombs of current per square foot of base member surface being plated, the base member being anodic during the discharge, to deplate unsound and inferior electrodeposited metal, and repeating the cathodic current and anodic condenser discharge cycle until a desired thickness of metal has been electrodeposited on the base member.

Automatic Buffing Machine

U. S. Patent 2,576,131. *G. A. Lyon.*

A buffing wheel assembly comprising a tiltable buffing wheel adapted to buff a workpiece at one end of its tilting movement, means for holding a buffing compound in contacting relation with the surface of said wheel when said wheel is at the other end of said tilting movement, means for advancing said holding means a predetermined distance towards said wheel operable when said wheel is out of contact with said buffing compound, and means for advancing said wheel towards said workpiece a predetermined distance before each buffing operation.

Plating Coiled Strip

U. S. Patent 2,576,074. *J. S. Nachtman.*

In a method of continuously electroplating coiled discontinuous metallic strip with coating of metal, the steps of unreeling said discontinuous metallic strip from supply coils, joining the discontinuous strips end to end, conveying the joined strips uninterruptedly under tension through a loop variable in response to tension changes and then in a fixed path through an electroplating operation by applying propulsive power to the strip after said electroplating operation, automatically segregating the plated strip into discontinuous lengths and automatically recoiling said discontinuous lengths, establishing a predetermined tension in the strip by applying power to the strip between the unreeling coils and said variable loop, and automatically regulating the rate of unreeling strip by controlling the magnitude and direction of the tension-establishing power in response to variations in said variable loop due to tension changes.

Gas Plating

U. S. Patent 2,576,289. *A. O. Fink, assignor to The Commonwealth Engineering Co. of Ohio.*

The method of gas plating dense coatings which comprises: heating an object to a decomposition temperature for metal-bearing vapors in a plating zone; moving gaseous material at least a portion of which decomposes depositing metal into the said plating zone; and moving the gas at a velocity of between about 40 and 90 feet per second in a turbulent fast moving stream directed against the surface of the object to be plated.

Wet Blasting Machine

U. S. Patent 2,576,008. *W. Gladfelter and R. R. Garver, assignors to Pangborn Corp.*

In a wet blasting machine, and in combination, a circuit including a slurry storage body for a slurry of abrasive particles, pump mechanism having an outlet and an inlet, said outlet being connected to the bottom of the storage body and the said inlet being connected to a slurry-receiving intake located in the storage body above the outlet a distance sufficient to receive a working amount of abrasive particles, for circulating slurry through said circuit and upwardly through said body for maintaining uniformity of suspension therein, a blast projector, and means for delivering slurry from the discharge side of said pump circuit to said projector.

Emulsion Cleaner

U. S. Patent 2,576,419. *J. H. Secrist and W. H. Petering, assignors to Detrex Corp.*

An optically clear, non-turbid, liquid, cleaning composition comprising the following ingredients in substantially the proportions stated:

Trichlorethylene	cc	100
Triethanolamine oleate	grams	2
Monoethanolamine oleate	do	6
Sodium oleate	gram	1
Water	cc	11

Electrolytic Separation of Tin and Lead

U. S. Patent 2,576,998. *R. F. Main and H. F. Hansen, assignors to Acme Steel Co.*

The process of electroplating zinc upon a cathode from a sulfate acid solution containing dissolved zinc salts as well as lead as an impurity comprising maintaining relative movement between the cathode and the solution, passing an electric current from the solution to the cathode, maintaining the temperature of the solution above 85°F., maintaining the zinc content of the solution above 50 grams per litre, and maintaining the lead content of the solution below 5 milligrams per litre by electrodepositing and removing lead as an impurity from the solution independently of the electroplating of the zinc from the solution upon the cathode.

Nickel Plating from Fluoride Baths

U. S. Patent 2,576,922. *E. L. A. Camin, S. E. Hybinette and H. B. Taylor, assignors to Kenmore Metals Corp.*

A method for producing a relatively ductile nickel plating on a metal base which comprises passing a current of less than 250 amperes per square decimeter from a nickel anode to the metal base to be plated through a bath formed essentially from a nickel compound, hydrofluoric acid, boric acid and water, said hydrofluoric acid reacting with said nickel compound to form a complex nickel fluoride, said hydrofluoric acid being present in a quantity in excess of that required to convert said nickel compound to said complex nickel fluoride, said bath containing at least 30 grams of nickel metal per liter, said excess hydrofluoric acid giving said bath a pH of more than 1 and less than 6, the anions of said bath comprising essentially fluorides and borates.

Acid Zinc Plating

U. S. Patent 2,576,999. *A. E. Chester and R. F. Main, assignors to Acme Steel Co.*

A method of zinc plating which comprises essentially electrodepositing zinc from an acid bath containing zinc sulfate and having a gluconate and an alkylated napthalene sulfonate dissolved in said bath, the quantity of lead in said bath being less than 5 milligrams per liter of solution, and carrying out said electrodeposition at temperatures above 100°F. and below 160°F.

Heavy Bright Rhodium Plating

U. S. Patent 2,577,364. *F. H. Reid, assignor to The International Nickel Co., Inc.*

In the process for electro-depositing thick plates of bright rhodium on metal using aqueous acid electrolyte containing at least one rhodium compound from the group consisting of rhodium phosphate and rhodium sulfate in an amount sufficient to provide said electrolyte with about 0.5 to about 5 grams per liter of rhodium, and free acid from the group consisting of phosphoric acid and sulfuric acid in an amount sufficient to prevent hydrolysis of the rhodium compound but not exceeding about 20 milliliters per liter of electrolyte; the improvement which comprises incorporating in said electrolyte about 0.07 to about 0.5 gram per liter of phenol whereby thick, light-colored and bright rhodium electro-deposits are obtained at thicknesses of at least about 10 millionths of an inch on metal surfaces by employing the aforesaid phenol-containing acid electrolyte.

Heavy Bright Rhodium Plate

U. S. Patent 2,577,365. *F. H. Reid, assignor to The International Nickel Co., Inc.*

In the process for electro-depositing thick plates of bright rhodium onto metal using an acid electrolyte containing at least one rhodium compound from the group consisting of rhodium sulfate and rhodium phosphate in an amount sufficient to provide said electrolyte with about 0.5 to about 5 grams per liter of rhodium, free acid from the group consisting of sulfuric acid and phosphoric acid in an amount sufficient to prevent hydroysis of the rhodium compound but not exceeding about 20 milliliters per liter of electrolyte with the balance essentially water; the improvement which comprises incorporating in said electrolyte about 0.001 to about 0.02 gram of lead as an acid-soluble lead compound whereby thick, bright rhodium electrodeposits are obtained on metal surfaces by employing the aforesaid lead-containing acid electrolyte.

Surface Coating for Aiding Deep Drawing of Steel

U. S. Patent 2,577,887. *R. C. Gibson, assignor to Parker Rust Proof Co.*

In a method of subjecting a stainless steel to deformation such as by drawing and the like; the steps of subjecting, until a substantial coating forms, the surface of the stainless steel to the action of an acidic aqueous solution comprising essentially oxalic acid, the ferric ion, and at least about 2% of the chloride ion; and thereafter subjecting the stainless steel to said deformation.

Anodizing Process

U. S. Patent 2,578,400. *C. C. Cohn.*

The method of treating aluminum comprising essentially the steps of successively forming anodically thereon a relatively pervious aluminum oxide coating and then anodically, in an electrolyte containing a substantial quantity of anions of chromic acid and substantially free of free sulphuric acid, a relatively impervious aluminum oxide coating underlying the relatively pervious coating.

Nickel Bath with Levelling Properties

U. S. Patent 2,579,636. *L. Weisberg.*

The method of electrodepositing nickel to produce smooth, ductile, easy-buffing deposits which comprises electrolyzing a body of a solution containing as essential constituents nickel sulphate 120 to 400 grams per liter, nickel chloride 15 to 60 grams per liter, formic acid 5 to 30 grams per liter, and boric acid from 30 to 40 grams per liter, the solution being free of ammonia and ammonium salts in amount which will deleteriously affect the smoothing action of the deposited nickel, and free from impurities in amounts of not more than 5 milligrams per liter of aluminum, nor more than 1 milligram per liter of chromium, not more than 20 milligrams per liter of copper, and not more than 1 milligram per liter of ferrous iron, purifying said body of solution with respect to said impurities, the frequency of said purification and the extent thereof being such as to maintain the purity of the solution, during electrolysis, within said limits, maintaining the pH of the solution, during electrolysis, between 2 and 4, and discontinuing the electrolysis before the electrodeposited nickel has exceeded a thickness substantially greater than 0.003 inch, whereby deposits are obtained which are ductile, easily buffed, and have a surface substantially smoother than the surface of the cathode on which they are deposited.

Blackening Iron Alloys

U. S. Patent 2,579,752. *I. L. Newell.*

The process of blackening iron and its alloys in which the metal is immersed in a solution consisting of a water solution of an alkali metal salt of an aryl sulphone monochloramide made alkaline with an alkali metal hydroxide, the hydroxide content being at least 15 times and not more than 125 times by weight of the chloramide, said solution containing sufficient water to give a boiling point from 250 to 300°F. and said solution being heated to a temperature between 250 and 300°F. and the metal held in said solution for a sufficient time to produce the desired depth of black.

Engineering Information Useful In Designating Metallic Surface Treatments

Engineering Data Sheet

THE ELECTROMOTIVE SERIES FOR METALS AND ALLOYS

ANODIC END

Lithium (—2.959 v)
Rubidium
Potassium (— 2.92 v)
Strontium
Barium
Calcium (—2.7 v)
Sodium (—2.71 v)
Magnesium and its Alloys (—1.55 v)
Aluminum (—1.33 v)
Beryllium
Uranium
Manganese
Tellurium
Zinc (—0.76 v)
Chromium (—0.56 v)
Sulfur
Gallium
Iron (Fe^{++}) (—0.44 v)

A (Note 1)
- Galvanized Steel (1)
- Galvanized Wrought Iron
- Al Zn-Mg Alloys (eg: Al-75S) (2) (3)
- Al-High Mg. Alloys (eg: Al-220)
- Al-Low Mg. Alloys (eg: A1-4S)
- Aluminum plus very low percentage of alloying Constituents (eg: Al-53S)
- Alclads

Cadmium (—0.40 v)
Al-Si-Mg Alloys (eg: Al-356)
Al-Cu Alloys (with or without small additions of Mg) (eg: Al-24S)
Al-Cu Alloys (with or without small additions of Zn) (eg: Al-113)
Al-Cu-Si Alloys (eg: Al-108)
Mild Steel
Copper Steel
S.A.E. 4140
S.A.E. 3140
Wrought Iron
Cast Iron
4-6% Chromium Steel, Type 501 or 502 (4) (Active)
12-14% Chromium Steel, Types 403, 410, 416 (Active)
16-18% Chromium Steel, Type 440 (Active)
23-30% Chromium Steel, Type 446 (Active)
Indium (5)
Thallium
Cobalt (—0.28 v)
Ni-Resist Cast Iron
50-50 Lead Tin Solder
17% Cr-7% Ni Steel, Type 301 (Active)
18% Cr-8% Ni Steel, Types 302, 303, 304, 321, 347 (Active)
23% Cr-14% Ni Steel, Type 309 (Active)
25% Cr-20% Ni Steel, Type 310 (Active)
18% Cr-12% Ni-3% Mo Steel, Type 316 (Active)
Hastelloy "C" (59% Ni, 17% Mo, 5% Fe, 14.6 Cr, 5% W, 0.1% C)
Lead (—0.12 v)
Tin
Iron (Fe^{+++})

Hydrogen (0.00 v)
Antimony
Bismuth
Arsenic

B (Note 6)
- Muntz Metal (60% Cu, 40% Zn) (4)
- Manganese Bronze (66.5% Cu, 19% Zn, 6% Al, 4% Mn)
- Naval Brass (Add. of ¾% Sn to Muntz Metal)
- Nickel (Active)
- 60% Ni-15% Cr (Active)
- Inconel (78% Ni, 13.5% Cr, 6% Fe) (Active)
- 80% Ni-20% Cr (Active)
- Hastelloy "A" (60% Ni, 20% Mo, 20% Fe, 0.1% C)
- Hastelloy "B" (65% Ni, 30% Mo, 5% Fe, 0.1% C)
- Yellow Brass (58-70% Cu, 0.50-1.5% Sn, 0.75-3.5% Pb, Balance Zn)
- Admiralty Brass (71% Cu, 28% Zn, 1% Sn)
- Aluminum Bronze (Add. of 2¼% Al to 75% Cu-25% Zn Alloy)
- Red Brass (85% Cu, 15% Zn)

Copper (-ic) (+0.522 v)
Oxygen
Polonium (+0.3+ v.
Copper (-ous) (+0.52 v)
Iodine
Tellurium (Te^{++++})

C (Note 7)
- Silicon Bronze (1.0 to 3.0% Si) (7)
- Nickel-Silver
- Ambrac (5.0% Zn, 20% Ni, Balance Cu)
- 70% Cu-30% Ni
- Comp. G-Bronze (88% Cu, 2% Zn, 10% Sn)
- Comp. M-Bronze (88% Cu, 3% Zn, 6.5% Sn, 1.5% Pb)
- Silver Solder
- Nickel (Passive)
- 60% Ni-15% Cr —25% Fe (Passive)
- Inconel (Passive)
- 80% Ni-20% Cr (Passive)
- Titanium
- Monel (70% Ni, 30% Cu)
- 12-14% Cr Steel, Types 403, 410, 416 (Passive)
- 16-18% Cr Steel, Type 440 (Passive)
- 17% Cr-7% Ni Steel Type 301 (Passive)
- 18% Cr-8% Ni Steel, Types 302, 303, 304, 321, 347 (Passive)
- 23% Cr-14% Ni Steel, Type 309 (Passive)
- 23-30% Chromium Steel, Type 446 (Passive)
- 25% Cr-20% Ni Steel, Type 310 (Passive)
- 18% Cr-12% Ni-3% Mo Steel, Type 316 (Passive)

Mercury (+0.85 v)
Silver (+0.80)
Lead (Pb^{++++})
Palladium
Bromine
Chlorine (+1.36 v)
Graphite (8)
Gold (-ic) (+1.3 v)
Gold (-ous)
Platinum
Fluorine

CATHODIC END

NOTES

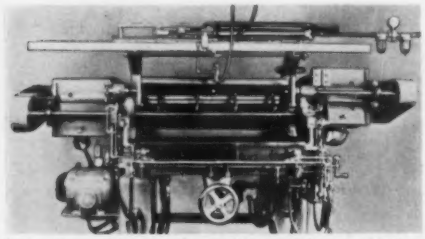
(1) Members of Group (A) are listed, relative to each other, but the position of the group with respect to the group between chromium and ferrous iron is uncertain. The group, however, is listed correctly between zinc and cadmium.
(2) Aluminum types are the standard designations of the Aluminum Co. of America.
(3) The heat treatment of aluminum and its alloys has an effect upon their galvanic potentials. They fall in the aluminum group, however, regardless of the heat treatment.
(4) Stainless Steel types are standard American Iron and Steel Institute designations.
(5) Indium, thallium, and cobalt are listed relative to each other, but their position relative to the stainless steels is uncertain. They are properly placed between aluminum and lead.
(6) The members of Group (B) are listed relative to each other, but the position of the group relative to ferric iron to arsenic is uncertain. The group is, however, properly placed between tin and copper.
(7) The members of Group (C) are listed relative to each other, but the position of this group with respect to iodine, tellurium, and mercury is uncertain. However, the group is properly placed between copper and silver.
(8) Graphite lies between lead and gold but its position relative to palladium, bromine, and chlorine is uncertain.

Recent Developments

New Methods, Materials and Equipment for the Metal Finishing Industries

Spray Gun Mover

The Lea Manufacturing Co., Dept. MF, 16 Cherry Ave., Waterbury 20, Conn.



Lea Gun Mover Assembly, with protective housing removed to show mechanism.

The Lea Gun Mover, a compressed air operated device for the Lea Emulsion Spray Method of applying liquid compositions, such as Lea Liquabrade surface finishing compounds, to wide faced buffs, has been introduced by *The Lea Manufacturing Company* of Waterbury, Conn. Developed in cooperation with the *Clair Manufacturing Company*, Olean, N. Y., Lea Gun Movers operate efficiently on any surface finishing equipment.

Before the development of this device, the use of liquid compounds was penalized because existing equipment continued to spray during directional halts, deceleration and acceleration. According to the manufacturer, the design principles incorporated in the Lea Gun Mover eliminate this overloading of sprayed surfaces and waste of compound.

In operation, the Lea Spray Gun Mover automatically completes one pass each time the operator trips the convenient foot pedal microswitch. This equipment is available in a series of different sizes—the largest provides a coverage of from 2″ to 40″ with one spray gun moving at a uniform speed over a straight line traverse, which is supplied with a dependable supply of clean, dry oil-free air at all times. Incorporating an absolute minimum of moving parts, all totally enclosed, the Lea Gun Mover is compact and easily installed. Basic component parts include: Solenoid Operated Air Cylinder, Moving Carriage with Adjustable Limit Stops, Adjustable Cam Operated Spray Control, Metal Enclosure, Traveling Spray Nozzle, Foot Operated Microswitch, Air Filter and Adjustable Automatic Pressure Control.

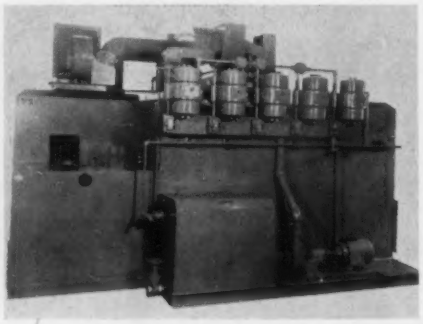
For additional details on the Lea Spray Gun Mover, write to the above address.

Spirits Washer Features One-Man Operation

Detrex Corp., Dept. MF, Box 501, Detroit 32, Mich.

A new mineral spirits washer designed especially for one-man operation has been placed on the market by this firm. The loading and unloading of the machine has been made a simple, one-station operation by the use of a return-type conveyor.

The cleaning cycle of this equipment consists of two washing stages and a forced air blow-off. Easily adjusted spray nozzles provide an even, all-over coverage of the parts being



cleaned, regardless of irregularities in shape. As in all Detrex spirits washers, a series of safety devices are incorporated in this machine. These include: Explosion proof switches and motors, all moving parts manufactured of nonferrous metal, a complete exhaust system, and an automatically actuated carbon dioxide system.

This washer offers a substantial saving in floor space over "cabinet-type" spirits washers and also provides an exceptionally high production cleaning rate, it is claimed. The Detrex mineral spirits washer offers the utmost in flexibility of application. It is designed to clean a variety of standard production parts, and it can be adapted to many special cleaning applications, according to the firm.

High Quality Potassium Cyanide at Technical Grade Prices

Chemicals Div. Octagon Process, Inc., Dept. MF, 15 Bank St., Staten Island 1, N. Y.

Platers having difficulty with bright plating baths and precious metal plating because of impurities in technical grade potassium cyanide will be interested in the announcement by the above firm, which now offers potassium cyanide which they claim is of exceptionally high purity, at technical grade prices. The company claims that "bugs" in bright plating and precious metal plating are eliminated and smooth operations assured with their material, since no sulfide impurities are present. According to the company, platers can now realize higher production standards without incurring extra costs.

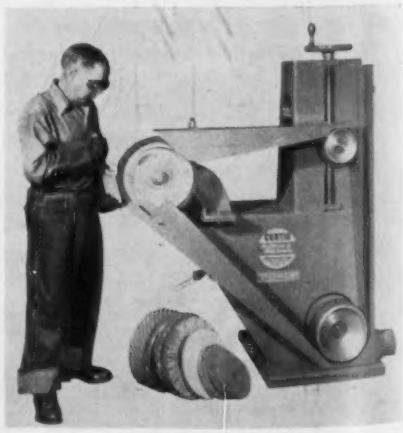
Belt Grinder and Polisher

Curtis Mach. Div., Lincoln Park Industries, Dept. MF, 1300 E. Second St., Jamestown, N. Y.

Heavy, welded-steel construction permits wide range of general grinding and snagging, along with flat and contour grinding and polishing, on the new Curtis Model 500 Strato-Belt abrasive belt grinder and polisher.

This rugged compact unit requires only 27″ x 50″ floor space.

The sealed bearing-spindle design permits quick interchange of all types of contact wheels, such as various widths, contours or special shapes with



Lea Copper-Glo*

Saves in Nickel

Saves in Copper

Saves in Time

Saves in Nickel...

because with it, plating of chromium on properly pre-finished steel and die-castings directly, without any intermediate buffing operation, is practicable.

Saves in Copper...

because of its exceptional brightness, no subsequent buffing or coloring of properly pre-finished work is necessary. With the standard sodium formula, 30 to 35% less copper cyanide is needed in make up than with other high speed processes. With potassium it is 10 to 15% less. There's less dragout loss; less salt tie-up.

Saves on Tank Time...

because the high current density, with its high speed plating, results in brilliant copper deposits of required thickness in a shorter period.

Saves in Buffing...

because of the bright, soft, easily-flowed copper deposit. Thus, where buffing or polishing is more economical than pre-finishing, considerable time is saved. Production per man is increased.

Lea Copper-Glo is proving a boon to the defense project. Let it help you in your problem of saving nickel, saving copper and saving time.

The Ronal Bright Copper Process, using Lea Copper-Glo, is a development of Ronal Chemicals, Brooklyn, N. Y.*

Burring, Buffing and Polishing . . . Manufacturers and Specialists in the Development of Production Methods, Equipment and Compositions

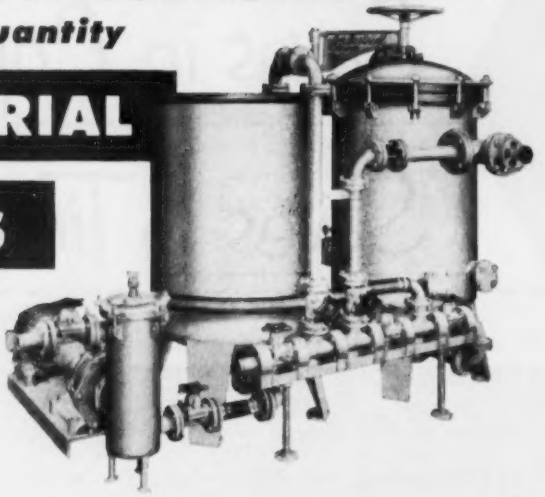
LEA®

THE LEA MANUFACTURING CO.
16 Cherry Avenue, Waterbury 20, Conn.
LEA MFG. COMPANY OF CANADA, LTD.
370 Victoria Street, Toronto 2, Canada

Bonus Performance

Filtering any plating solution . . . any quantity

INDUSTRIAL Filters



Portable and stationary models. Capacities from 100 to 15,000 gph. Special filtering systems engineered to meet unusual conditions.

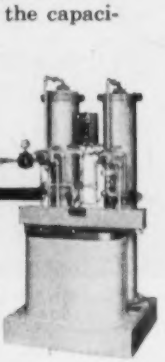
and it's performance that counts

The engineering, design, and construction of INDUSTRIAL filters have proved out in long service. With the outlet near the top of the chamber, a uniform precoat is deposited on the filter leaves as the solution fills the chamber. The outside lockup simplifies the lockup of the leaf and bag assemblies. INDUSTRIAL exclusive air-wash cleaning method practically eliminates the usual labor, downtime, and the inconveniences of dismantling the filter after each cycle. INDUSTRIAL filters are often in operation for months without removing the cover. All these features add up to bonus performance—clear filtrate at low over-all cost per gallon.

Ask for Bulletin 100-EP

This bulletin gives the complete details of all INDUSTRIAL features, description of the different standard models, and the capacities of the standard sizes.

INDUSTRIAL Water Demineralizers



Eliminate stains after hot rinses; prevent unwanted precipitates in solutions.

Standard INDUSTRIAL demineralizer units are available with capacities of 200 to 1000 gph. Special units of any capacity are engineered to requirements.

Write for Full Information and Recommendations

FILTERS Pressure Type · PUMPS Centrifugal · CORROSION TESTING APPARATUS Salt Fog • Humidity

INDUSTRIAL FILTER & PUMP MFG. CO.

5906 Ogden Avenue
Chicago 50, Illinois

RUBBER DIVISION Vulcanized Linings • Molded Products · WATER DEMINERALIZERS

various hardness neoprene covers, or soft buffing wheels from ½" to 4" without special bearings.

The hand screw adjustment of the aluminum idler pulley permits the use of large or small diameter contact wheels, maintaining the same belt length and belt speed for maximum efficiency and cutting.

Convenient, positive belt-tracking mechanism convenient to the operator permits the use of narrow and wide belts.

The abrasive belt being pulled through the grinding instead of being pushed eliminates puckering, and permits true grinding and polishing with increased belt life, it is claimed.

Special serrated Curtis contact wheels are said to provide faster cutting, prevent belt glazing, eliminate grinding chatter and prolonged belt life.

Copper Plated Racking Wire

Bart-Messing Corp., Dept. MF, 229 Main St., Belleville 9, N. J.

To help alleviate the shortage of copper wire so widely used for wiring small parts for plating, the above firm has introduced a copper plated steel wire which is soft enough to enable the operator to make excellent contacts with the parts. The wire is available in gauges from 16-24, and comes in 25 lb. coils for ease of handling and storage.

Acid and Fume-Proof Rectifier

Wesley Block & Co., Dept. MF, 3915 Main St., Flushing, N. Y.

A completely air-sealed selenium rectifier unit is being offered by the above company. The rectifier (manufactured by *Richardson-Allen Corp.*) operates on the "heat exchange" principle. It may be installed in corrosive atmospheres without danger to the selenium stacks, to the transformer or to any other components, it is claimed. This development greatly widens the field for application of selenium rectifiers as a dependable source of DC. It may be used with entire safety adjacent to or above cleaning and pickling vats in chemical factories and laboratories, in mines and in other locations in which corrosive atmospheres are prevalent. Complete technical information will be sent promptly to engineers and others who are dependent upon the use of DC power for vital operations.

Ground Corn Cobs

Frank Miller & Sons, Dept. MF, 2250 W. 58th St., Chicago 36, Ill.

Manufacturers who use ground corn cobs for drying, buffing, tumbling or polishing will be interested in the announcement just made by the above firm. They have made arrangements for the entire ground corn cob output of a large mill which was constructed exclusively for this purpose. The new product, called Cob-Dri, will be available in a choice of three popular grades, coarse, medium and fine, and will be fully dustfree and graduated to exact uniformity. Orders for Cob-Dri will be accepted on any quantities from one bag to a carload. Samples, prices and freight costs can be obtained by writing.

Plating Thickness Gauge

Gardner Laboratory, Inc., Dept. MF, Bethesda 14, Md.

This firm announces the availability of a new, direct reading gauge for measuring the thickness of non-magnetic coatings on magnetic base metals. Accuracy is stated to be within 5% at nominal plating thicknesses, and deposits up to .020″ can be measured. The unit is small, compact, and self-contained, requiring no outside batteries, etc. It has a pointer-locking arrangement that permits measurements to be made in areas where it is not possible to see the scale with the eye. Concave or convex surfaces can be measured—down to a ⅛″ radius on convex surfaces, and down to a 1″ radius on concave surfaces. The instrument is readily checked for accuracy by means of calibrating shims furnished with each instrument. Comes complete in a leather carrying case. Complete details may be obtained by writing to the above address.

High-Strength Polishing Glue

The Hanson-Van Winkle-Munning Co., Dept. MF, Matawan, N. J.

The above company announces a newly improved high-strength glue especially compounded for binding the abrasive to the surface of metal-polishing wheels.

The glue, known as Belgrade Glue, has improved water absorption qualities which result in greater quantities of prepared glue from each pound of dry glue, it is claimed. In addition, the glue has the proper viscosity, flexi-

WYANDOTTE CHEMICALS

Specialists in Industrial Cleaning Products

Photo Courtesy Whirlpool Corp.

How Wyandotte Service helped the Whirlpool Corporation!

THE SPARKLING white Whirlpool automatic washers you see coming off the production line are really wonder workers. They're going to save time, trouble and money for a lot of people.

Behind their manufacture is a great success story. It began with an idea. It grew through ingenuity and the finest methods and machinery obtainable to mass-produce quality products. Wyandotte (the world's largest manufacturers of specialized cleaning products for business and industry) has worked hand-in-hand with Whirlpool over the years.

Mr. Morgenstern of the Whirlpool Corporation reports: **"When we switched over to modern, high-speed equipment for finishing Whirlpool parts, a Wyandotte representative worked with us night and day. He recommended the right metal cleaner for each job . . . We are currently using Wyandotte BN, EMLON*, METAL CLEANER 38 and R2 in our various processes. We figure his efforts saved us time, upped quality, and cut cleaning costs."**

Have you a metal cleaning problem? Contact us! *Wyandotte Chemicals Corporation, Wyandotte, Michigan; also Los Angeles 54, Calif.*

CLEANING THE WORLD

*REG. U.S. PAT. OFF.

Largest manufacturers of specialized cleaning products for business and industry

Wyandotte CHEMICALS

Helpful service representatives in 88 cities in the U.S. and Canada

From deburring tubing . . .

to sanding bevels

Armour Backstand Belts do the job right

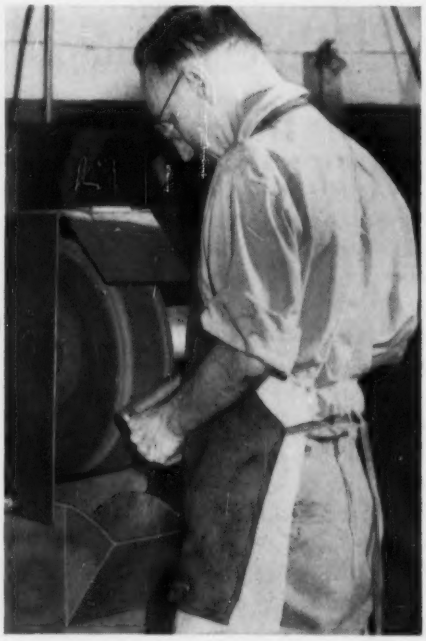
For the thousands of jobs where backstand belts can save you time, for the thousands of jobs other coated abrasives do so well, Armour has the answer—there's an Armour coated abrasive to do *your* job right.

Saves 3 out of 5 minutes!

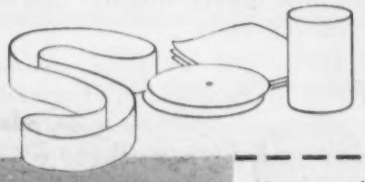
The LeRoi Company in Cleveland, Ohio, switched from set-up wheels to backstand belts in finishing forged paving breaker handles. Finishing time was reduced from 5 minutes 11 seconds to 1 minute 32 seconds—*saving 3 minutes 39 seconds per handle!* Now they know, too, that Armour's coated abrasives cut faster, last longer, and give a better finish.

Belts are only one of the many forms of coated abrasives available to you from Armour. There are more than 30,000 different varieties in grit size, backing, etc. Sheets, rolls, discs, tubes—and specialty sizes to meet your specifications.

Let your industrial supply distributor tell you about this complete Armour line. And ask him for your free copy of the booklet, "Facts about Backstand Belt Grinding and Polishing"—or send the coupon today.



We recommend buying through your industrial distributor



ARMOUR *Coated Abrasives*

MAIL THIS COUPON TODAY

Armour and Company • North Benton Road • Alliance, O.

Please send me the free booklet, "Facts about Backstand Belt Grinding and Polishing."

Name .....

Title .....

Firm .....

Address .....

City ..... *Zone* ..... *State* .....

bility and strength characteristics required to prevent abrasive from tearing loose while the wheel is in operation. Abrasive waste is decreased and the number of set-ups required is reduced, according to this firm.

Belgrade Glue is a hide glue supplied in ground form and packaged in barrels and 100-lb boxes.

Non-Foaming Cleaner

Kelite Products, Inc., Dept. MF, 3401 West Touhy Ave., Chicago 45, Ill.

Developed especially for use in pressure washers, Kelite Formula 973 is a heavy duty, non-foaming cleaner of brass, iron, steel, bronze, magnesium and all other metals except aluminum and aluminum alloys.

This new Kelite cleaner is said to have exceptional penetration and oil emulsifying abilities. Its repression powers keep hard water scale from forming, and will eventually remove old deposits already formed, it is claimed. Good rinsing properties are built into this cleaner, according to the firm.

The efficiency of a pressure washer depends not only upon the compound but also upon the contact angle of spray jets, the volume and temperature of the cleaning solution on the work. Kelite service engineers are equipped to check these points when the Kelite process is installed.

New Phosphate Process Aids Extrusion

Detrex Corp., Dept. MF, Detroit 32, Mich.

Extrudite, a phosphate coating compound used in the cold-forming and drawing of steel, is announced by this firm.

This process produces the tough lubricating film necessary throughout an extrusion or deep drawing operation. This "skin" of heat-resistant lubrication is locked to the metal's fine-grained, porous phosphate coating. As the cold-formed metal flows or is drawn in the die, it carries the phosphate coating and the lubricant along with it. Even under the most severe draws or extrusions, the protective "skin" remains as a continuous covering over the entire part being worked.

Further advantages offered by the process are: prolonged life of expensive dies, minimum metal scrapping due to the elimination of many machining operations, and a reduction

in "shut-down" time for die maintenance. Complete details are available on request.

Removing Oil & Water From Compressed Air Lines

Strong, Carlisle & Hammond Co., Dept. MF, Cleveland 13, O.

For years, water and oil in the compressed air lines have plagued platers. The above firm has a product that is said to provide a quick solution to the problem.

The reason for the troublesome water and oil goes back to a law of physics that is well known but often isn't considered. Compressed air carries suspended moisture taken from the air during the process of compression. As air is pushed through the lines, it drops in temperature, causing this moisture to condense into water. The SC&H combination separator and trap mechanism removes the moisture (and oil) from the air and drains it off.

Complete details are available by writing to the above address.

Protecting Outside of Tanks

The Lankote Div., J. Landau Co., Dept. MF, 221 Wooster St., New York 12, N. Y.

The exteriors and interiors of acid and plating solution tanks can be protected against corrosion by Lankote 200 series plastic coatings. Lankote 200 series can be easily brushed or sprayed and are highly resistant to acid, alkali, salt and hot water solutions, it is claimed.

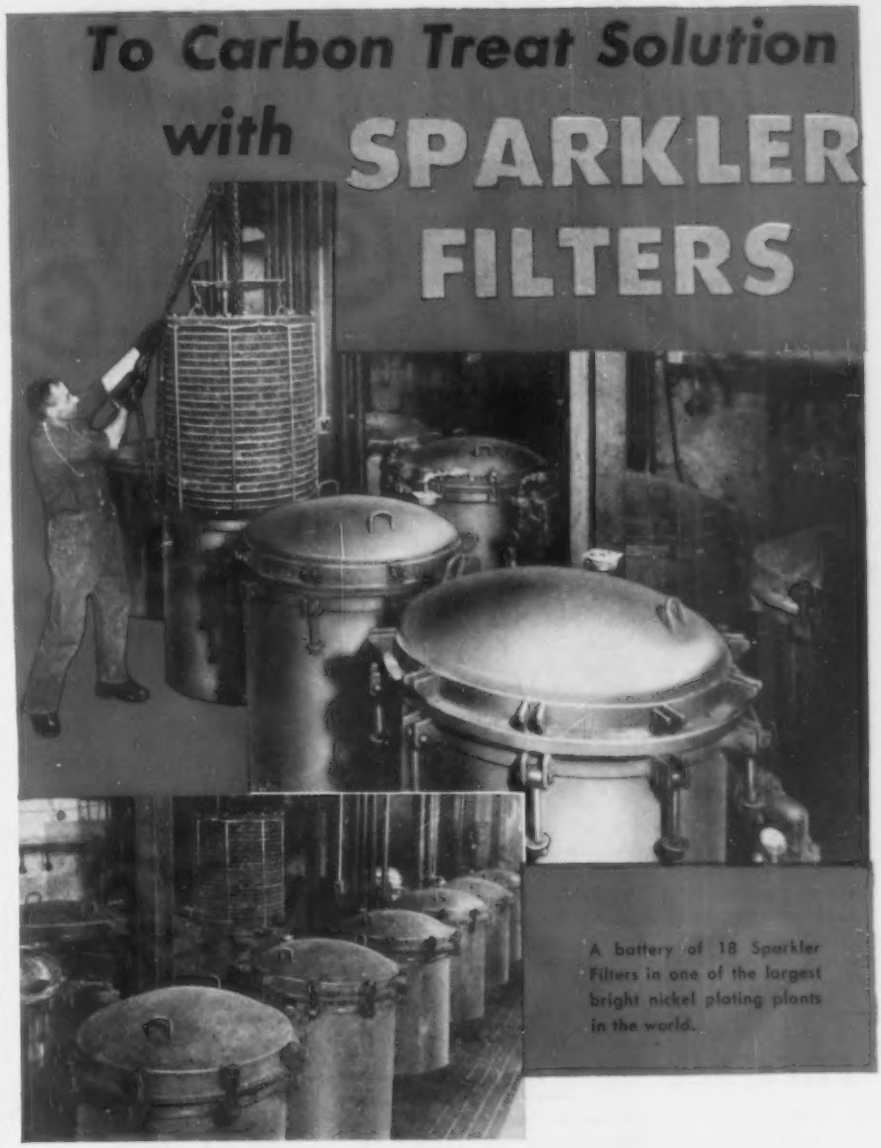
Wet-Blasting to Eliminate Glare on Plated Parts

American Wheelabrator & Equipment Corp., Dept. MF, 1150 S. Byrkit St., Mishawaka, Ind.

Reducing glare on plated parts is a typical application for the Liquamatte, a new wet blasting machine recently introduced by the above firm. The dials in the picture have both been chromium plated, but the one on the left has been given a surface treatment by liquid abrasive blasting, while the dial on the right has been untouched since plating. The glossy dial on the right reflects light to such an extent that it cannot easily be read, but the one on the left, being very slightly roughened, diffuses the light and is easily read. Since the abrasive

NO SHUT DOWN

To Carbon Treat Solution with SPARKLER FILTERS



A battery of 18 Sparkler Filters in one of the largest bright nickel plating plants in the world.

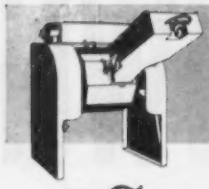
Carbon treatment without shut down is accomplished by cutting out one or two units in a battery of filters, removing the cartridge assembly of filter plates, and replacing with a new plate cartridge dressed with clean filter paper. The proper amount of carbon is mixed with water in a standby tank and recirculated through the filter thus depositing the carbon on the new plates in a cake of uniform thickness and density. The solution requiring a carbon treatment is then circulated through the carbon beds giving the plating solution the carbon treatment without contaminating the tank or stopping plating operations.

The quick change feature of the plate cartridge in Sparkler filters permits replacing a set of plates in a matter of minutes. Production can be resumed without appreciable interruption.

Sparkler Horizontal Plate Filters give absolutely sharp filtration at all stages of the cycle.

SPARKLER MANUFACTURING CO.
Mundelein, Illinois
European Plant—Herengracht 568, Amsterdam, Holland

SPARKLER horizontal plate FILTERS



BARREL FINISHING NEWS

"Super Honite" chips last twice as long!

Now you can speed your barrel finishing with the world's toughest abrasive chip—"Super Honite!" It's the hardest chip ever produced—the *only* chip engineered for both grinding and burnishing. Gives twice the life of other stones!

What makes it so tough? Aluminum-oxide mineral grains—*fused* with a ceramic bonding agent that never fractures or crumbles. And "Super Honite" *holds* these thousands of razor-sharp cutting edges permanently—*can't* wear smooth.

Try it yourself and see the difference. Available in eight sizes. Write Dept. MF-81 for the name of your nearest supplier.

ANOTHER 3M COMPANY PRODUCT

Regular "Honite" proves toughest natural chip

Competitive tests prove no other *natural* barrel finishing abrasive—not even granite—retains a cutting edge as long as regular "Honite!" Thousands of tiny, sharp silica grains are held tightly in a tough mineral bonding. Thousands of new cutting edges are constantly exposed as the surface slowly wears away.

That's why "Honite" is ideal for fine finishing to close tolerances, and for many other jobs involving a minimum amount of metal removal.

Insist on the brand name—"Honite." Available in nine sizes for uniform results. Write Dept. MF-81 for the name of your nearest supplier.

"HONITE" COMPOUNDS *are the "secret of success" for dependable finishing. Each type is carefully formulated to control alkalinity, lubrication, glazing—many other vital operating conditions. Ideal with "Honite" or "Super Honite."*

FREE help from Barrel Finishing Experts!

Are you positive your present barrel finishing methods are giving you the best results at the least possible cost? Experienced 3M Engineers are ready to work with you for increased efficiency and a system that's tailored to your *particular* job. Use coupon below for complete information and a copy of "3M Barrel Finishing." No obligation.

Minnesota Mining & Mfg. Co.
Dept. MT-452, St. Paul 6, Minn.

Name.....

Firm.....

Address.....

City.....Zone...State.....

Honite® BRAND

BARREL FINISHING CHIPS • COMPOUNDS • EQUIPMENT

Made in U.S.A. by MINNESOTA MINING & MFG. CO., St. Paul 6, Minn., also makers of "Scotch" Brand Pressure-sensitive Tapes, "Scotch" Sound Recording Tape, "3M" Abrasives, "Underseal" Rubberized Coating, "Scotchlite" Reflective Sheeting, "Safety-Walk" Non-slip Surfacing, "3M" Adhesives. General Export: Minnesota Mining & Mfg. Co., International Division, 270 Park Avenue, New York 17, N. Y. In Canada: Minnesota Mining & Mfg. of Canada, Ltd., London, Canada.

action can be closely controlled through the use of very fine-mesh abrasives, there is no danger that deceased features or lettering on work will be damaged, it is claimed.

Gears Deburred on Rotary Automatic Buffing Machine

Osborn Mfg. Co., Dept. MF, Cleveland, O.

Power brushing, although a relatively new production process, has found its place in almost every conceivable industry.

The teeth on these airplane gears were formerly rounded by hand. Two and one-half hours were required for each gear, and even with great skill, scrap loss was high.

One of the biggest factors in the growth of the power brushing industry is the work done by the *Osborn Manufacturing Co.* who manufactures a substantial portion of the power brushes used in industry today.

In developing their business, Osborn took the stand that each application, whether it be the removal of burrs, sharp corners, tool marks or scratches, or the improvement of surface finish and detection of cracks, must be engineered. Each job had its own characteristics, and each must be studied by someone familiar with power brushing techniques, construction of brushes, and effects of brushing speed, brush size and manner of presenting work to the brush. The accompanying illustration shows a typical engineered application of power brushing.

Abrasive-Belt Grinder for Large Area Surfacing

The Porter-Cable Machine Co., Dept. MF, Syracuse 8, N. Y.

A new all-purpose belt grinder

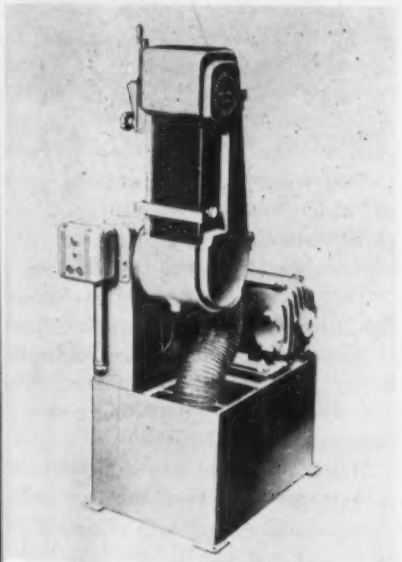
which is adaptable to a wide range of grinding operations has just been placed on the market by the above company. Equipped with a standard 6" belt which runs over a 12½" platen, the new grinder is an economical size for medium work. It handles jobs which previously had been run on wider and more expensive belts in production lines, job shops, tool rooms and maintenance and repair departments.

The grinder, designated Model 506, is used primarily for free-hand applications on work which requires flat surfaces, deburring, squaring, chamfering, rounding, and polishing.

This new machine can be changed over from vertical to horizontal operation in only one minute by simply loosening two hex nuts. The work is supported by a work rest and squared with the platen.

The Model 506 Grinder is equipped with two-speed pulleys for 3,300 and 4,000 S.F.P.M. The pulleys are quickly and easily changed to the proper surfacing speed. An optional set of pulleys for 2,400 and 5,500 S.F.P.M. is also available at no extra cost.

A pretensioning device eliminates the need for releasing the entire idler tension pressure each time the belt is changed. An adjustment knob provides speedy belt alignment.



This machine, with a built-in coolant system, may be used for grinding all materials requiring a wet abrasive belt. The 24 gallon tank has a large chip basket to facilitate clean out. The pump forcibly sprays coolant on the belt within the machine to flush grindings from the belt. The coolant then runs downward through a large flexible dust

X Here's how to get "NEW" NICKEL without NPA Approval ...and Save 2 ways

If you are a nickel anode user, you are confronted with the serious problem of securing nickel for anodes. New Jersey Metals Company can help you alleviate this problem —and save you money too!

Your own pure nickel scrap represents a potential source of new anodes. New Jersey Metals, with the finest melting and casting equipment available, will convert your nickel anode ends and stubs into new cast oval nickel anodes . . . cut to specified lengths, drill and tap for hooks . . . and send the new anodes back to you ready for use.

The reclaiming process assures you of "new" nickel without further N P A approval. In addition, it results in a saving of five to ten cents a pound over the purchase of new anodes.

New Jersey Metals processes all metals under rigid laboratory controls and guarantees that the purity content of the material returned to you will be the same as that received.

Complete service in ten days. Immediate quotations are made on any quantities. Laboratory analysis without obligation or charge.

...Call EL 2-6465 ... or write

New Jersey Metals Co.

Serving industry from coast to coast since 1920

714 ROCKEFELLER ST., ELIZABETH 2, N. J.

On any steel blackening problem

DEPEND on DU-LITE for a Superior Finish

Courtesy The Poly Choke Co.

Du-Lite gave this part with its complicated knurls, slots, threads, etc. a fine rust-resistant durable black finish. It is typical of many other parts, small and large, which have been black oxidized by Du-Lite for many years. Moreover, Du-Lite meets most individual and government specifications including 57-0-2C for Type III Black Oxide finish.

Du-Lite installations are simple, compact, easy to operate. Du-Lite equipment can be tailored to fit production requirements on all types of jobs with a maximum of speed and economy. Du-Lite also makes a complete line of cleaners, strippers, wetting agents, passivating agents, rust preventatives, burnishing compounds etc. for any metal finishing application.

See your nearest Du-Lite Field Engineer or write for more information.

DU-LITE CHEMICAL CORP.
MIDDLETOWN, CONN.

Rush information on your metal finishing products.

Name.....

Company.....

Address.....

City..... Zone..... State.....

Du-Lite
METAL FINISHING SPECIALISTS

tube and is filtered twice before re-entering the pump.

Standard equipment for the dry model includes the adjustable motor platform; removable, reversible cast iron platen; work rest; chip basket. The wet model includes all the dry model equipment plus a coolant system with belt driven pump; splash guard and coolant filter.

The drive unit for the machine is 3 H.P., 220/440 volts, 60 cycle, 3 phase, 1,750 R.P.M. It is totally enclosed with across-the-line starter and wiring.

A work table is available as accessory equipment. It is 10″ wide by 7″ deep, adjustable to 45 degrees. The table is slotted for a gauge which is adjustable through 90 degrees.

Further information will be supplied upon request.

Bench Model Hard Chrome Plating Unit

The Cro-Plate Co., Inc., Dept. MF, 747 Windsor St., Hartford, Conn.

The above company announces the availability of the new Cro-Plater "100," a completely self-contained precision hard chrome plating unit capable of meeting all electro-plating requirements. With this new plater, shops large or small can effect immediate and substantial savings by doing their own plating on their premises, it is claimed. Tests prove that cutting tools, gauges, dies, molds and machine wear parts average 300% longer life, when chrome plated, than non-plated counterparts. Additionally, mis-machined or under-size ground tools can

be salvaged by chrome plating back to size in the Cro-Plater "100."

The bench model plater requires a space of only 2′ x 3′ yet all controls, transformers, rectifiers, switches and heating elements, including the plating tank, are contained within the unit. A current source and duct outlet are the only connections required for immediate operation.

Construction of the Cro-Plater "100" is angle-iron for rigidity. The tank is lead-lined Armco iron and this lining can be changed for the plating of other metals. Tank heating is accomplished by easily-removed 1500 watt electric heaters.

Rectifiers are horizontally forced air cooled by a fan and bath temperature is thermostatically-controlled. All circuits are overload-protected with self-resetting, heater type switches. The unit provides a rectified source of DC power up to 100 amps. at 0 to 12 volts.

Industrial Cleaning Machine for Fine Parts

Zenith Mfg. Co., Dept. MF, 52 Beekman St., N. Y. 38, N. Y.

This firm, manufacturers of a line of widely used watch cleaning machines, announces a new type of cleaning machine for all industrial uses.

The new machine, called "Instro-Met," has been more than three years in the making and is designed specifically for cleaning every kind of instrument with small or large delicate parts.

Many new and revolutionary improvements have been incorporated in "Instro-Met" to increase efficiency and assure highest safety.

1. Three clear-view windows on motor support for instant checking while machine is in operation.

2. Spun aluminum tanks and covers instead of hazardous glass. All are 10″ high and have 10″ diameters—4 gallon capacity.

3. Heavy cast aluminum basket with 33⅓% more capacity . . 7$\frac{3}{16}$″

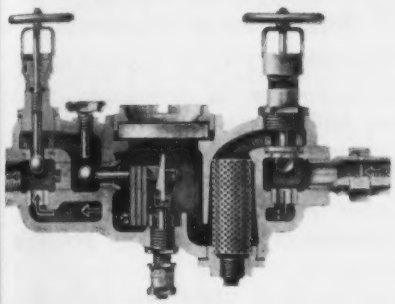
inside diameter; 3¾" deep. Basket also has three monel mesh removable compartments for cleaning a variety of different parts simultaneously.

4. Simple snap-on operation of basket to impeller shaft eliminates hazards of accidental loosening. Inner steel tube of center supporting column is splined for automatic centering over tanks and dryer. Basket lowers only when in proper position. "Fingertip" control enables female operator to work the machine without fatigue.

5. Overall size: 23¼" x 26¼"—26" high.

New Steam Trap

Velan Engineering Co., Dept. MF, 1 Exchange Place, Jersey City, N. J.



The Universal Velan steam trap, type by-pass is claimed to be the only design of its kind on the market. It is specially designed for the processing industries where continuous uninterrupted operation is essential. Two special valves are incorporated in the trap and have a unique signalling device indicating even to an unskilled operator in which position the valves are. The draining device can be completely closed, steam and condensate can be by-passed, and all internal parts of the steam trap replaced, or the condensate lines can be cleaned with live steam to remove alkaline deposits, scale and other matter which is speeding up corrosion of costly return lines.

The complete unit weighs only 16.2 lbs. and is said to represent the most complete drainage control of steam using equipment ever produced. It combines:

High capacity trap with ½ or ⅝ orifice,
High capacity air vent,
Check valve,
Control glass,
BTU's economy controller,
By-Pass.

The unit can be installed in any position and one type can handle pressures from 0-350 p.s.i.

For Carbon or Stainless Steel... *SPEEDIE* Compositions are *BEST!*

In these days when steel is not always the best, a real challenge is presented to the buffer. To make your job *easier*, our engineers have developed *SPEEDIE* Compounds which do a *better* job of cutting and coloring . . . and give your customer the finish he demands!

If you're having difficulty buffing cold roll or carbon steel, investigate the rugged No. S-2269 *SPEEDIE* Buffing Compound. Designed for work with a Sisal buff, it does a real job of cutting out scratches and pit marks. Then you can get a superior finish with No. S-257A or S-471 *SPEEDIE* Buffing Compounds. They'll give you the results needed.

Write Today for the New *SPEEDIE* Composition Book. Just Off the Press!

Polishing Room Supplies and Accessories

BP THE BUCKEYE PRODUCTS CO.
7033 Vine Street Cincinnati 16, Ohio
Cable address: Buckprod

Parts Cleaning Machines

Vic Cleaning Machines Co., Dept. MF, 1313 Hawthorne Ave. Minneapolis 3, Minn.

This firm announces a complete line of machines for all industrial washing and cleaning operations. Among the newest additions to their line is the Model 51 degreaser and parts cleaner pictured above. Designed for room-temperature solvent cleaning of a wide range of items, the machine is equipped with a pressure jet arrangement for loosening stubborn deposits which do not come off in soaking. All types of solvents can be used in this machine, which is zinc lined to prevent corrosion. The outside is painted with solvent resistant paint to maintain an attractive appearance at all times.

Complete details may be obtained by writing to the above address.

Rust-Inhibiting Metal Cleaner

Pennsylvania Salt Mfg. Co., Dept. MF, 1000 Widener Building Philadelphia 7, Pa.

Pennsalt EC-51, a new rust-inhibiting organic-type metal cleaner, has been announced by the above company.

Newest addition to the Pennsalt line of emulsion cleaners, the new product is said to combine powerful detergent action with a high degree of rust protection.

Steel parts cleaned in Pennsalt EC-51 obtain protection from rusting for up to six weeks under normal plant

HUSSEY
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Here are the basic tools for real craftsmanship in electroplating. Available in a full range of shapes and sizes, Hussey Pure Copper Anodes assure uniform finish and fast, dependable plating.

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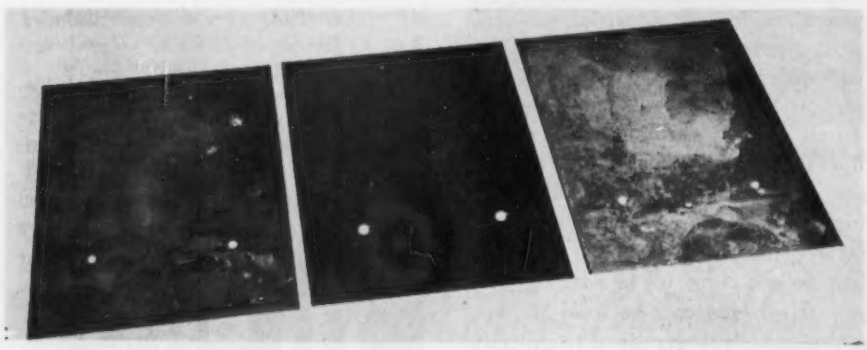
NEW YORK.....140 Sixth Avenue
CINCINNATI.....424 Commercial Square
CHICAGO.....3900 N. Elston Avenue
ST. LOUIS.....1620 Delmar Boulevard
PHILADELPHIA.1632 Fairmount Avenue

conditions, it is claimed. Even under unfavorable conditions, protection for two to three days can be expected, according to the firm. The new cleaner is said to be equally efficient in removing soil from all of the non-ferrous metals without staining or etching.

Developed at Pennsalt's Whitemarsh Research Laboratories, the product has been field tested in a number of metal processing plants. In addition to providing cleaning and rust inhibition in a single operation, EC-51 has also proven highly successful in cleaning prior to painting.



After three weeks of normal plant exposure, the middle panel, which had been cleaned in Pennsalt EC-51, showed no signs of rusting. The other two specimens, cleaned in other types of emulsion cleaners, rusted after two days under the same exposure conditions.

Pennsalt Cleaner EC-51 is used in concentrated or diluted form and can be applied by both spray and immersion methods. In spray cleaning, a dilution of from 50:1 to 100:1 will apply to most cleaning and rust protection applications encountered in industry.

The new cleaner is claimed to be non-caustic, non-explosive, harmless to the hands and does not create toxic working conditions. It is manufactured at the company's Cornwells Heights, Pa., plant and is packaged in 50-gallon drums.

Process for Making Nickel-Coated Aluminum

Development of a process for the nickel coating of aluminum, which may find many applications in industrial manufacturing, was announced jointly by *Hamilton Standard Div., United Aircraft Corp.* and the *Bart Laboratories Co., Inc.*, of Belleville, N. J.

S. G. Bart, president of the Bart Laboratories, said the new process solves a major problem in the coating of aluminum with nickel to give a stress-free, hard, yet resilient coating. A synthetic rubber compound developed by Hamilton Standard is used to establish a bond, previously unattainable, between the aluminum and nickel plate.

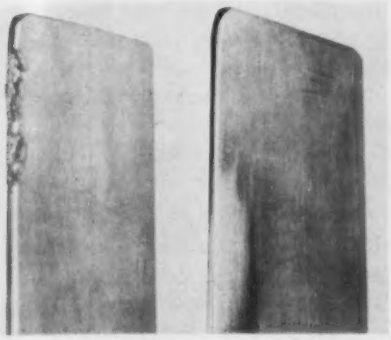
Erle Martin, general manager of Hamilton Standard, said the plating process had taken almost two years to develop for the Air Force and the Navy in co-operation with the Bart organization. It is of major importance to Hamilton Standard, he said, in protecting duralumin propeller blades from the pitting and eroding effect of spray thrown up in sea landings and takeoffs.

Solid duralumin propeller blades equipped with the coating already are in service on the Navy's Martin P5M-1 flying boats and Grumman UF-1 utility amphibians. Several hundred service landings and takeoffs with the two airplanes have conclusively demonstrated the coating's protective ability.

Nickel-plated blades emerged from a special Navy testing program unscathed, while unplated blades were severely eroded. Test conditions at Hamilton Standard, far more severe than those ever encountered in actual

service employed high pressure streams of water and cinders. Plated blades were unharmed, but unplated blades lost approximately twenty per cent of their tip area.

Mr. Bart said that the process and its variations will open up many applications for aluminum which were



The tip of a duralumin propeller blade (left) shows effect of beating administered by high-pressure stream of water. Blade coated with nickel plate (right) is undamaged after identical treatment.

previously considered impossible or impractical. The process combines the hardness and corrosion resistance of nickel with the many advantages of aluminum, he added.

Mr. Bart, who has named the plating process "Alni-Clad," disclosed that the bond between the organic synthetic base and the nickel has an extremely high adhesion or tensile strength. It will stand up, he said, under a wide range of temperatures.

The bond material is sprayed onto aluminum to the required thickness. After drying, the piece is then plated with nickel by conventional means, the plate thickness depending upon requirements. With present operational facilities, Mr. Bart said, a component can be "Alni-Clad" in approximately 24 hours.

Satisfactory results have been obtained with all aluminum alloys used to date, Mr. Bart said. Finished "Alni-Clad" pieces have a hardness of 400-450 Vickers and are stress-free. Intricate designs can be given uniform and accurate protection of interior and exterior surfaces with the proceses.

Finished pieces have a semi-bright surface which can be polished chemically or mechanically to a high luster.

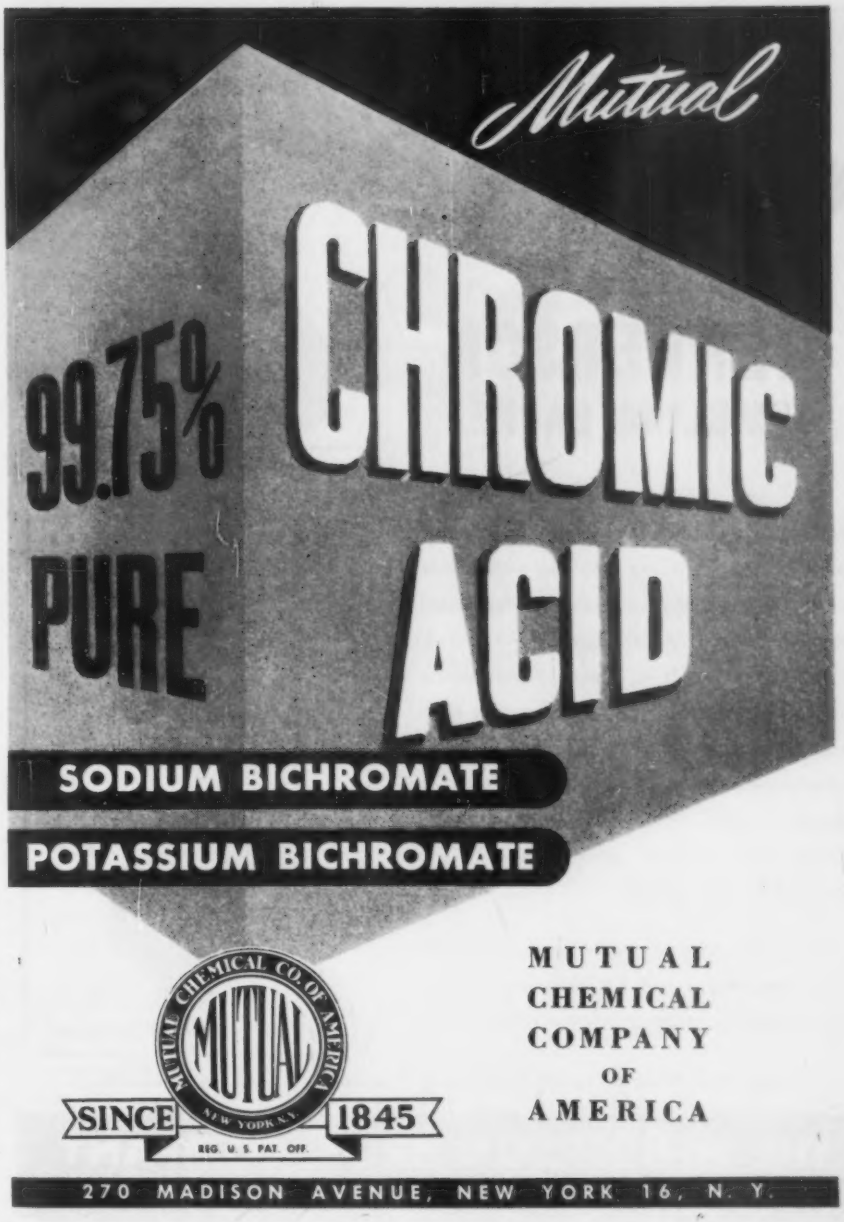
Standards for Surface Roughness

American Standards Ass'n., Dept. MF, 70 E. 45 St., N. Y. 17, N. Y.

A guide to designers, inspectors, and specification writers in designating the type of surface desired on industrial products, more particularly those with machined surfaces, has just been approved by the American Standards Association. This document is the American Standard for "*Physical Specimens of Surface Roughness and Lay, B46.2-1952.*"

Two types of physical specimens are described in the standard. One type is for general purpose specimen blocks —blocks which represent typical machined flat surfaces as actually produced in the shop. The other type of block is used for precision reference work such as checking the calbration of surface roughness measuring instruments, and is not intended to represent surfaces as produced in the shop by actual machining operations.

For general purpose blocks the standard contains a table listing, for various types of finishes, a range of roughness heights in microinches, lay, and roughness width in inches. Six classes of surfaces are included: honed, lapped or polished; ground with periphery of wheel; ground with flat side of wheel; shaped or turned; side-milled, end-milled, or profiled; and milled with periphery of cutter. Altogether, nine roughness height values are given ranging from 2 to 500 microinches. For each range of roughness height values, a tolerance is given. For example, for shaped or turned surfaces with roughnes heights ranging from 32 to 500 microinches, the tolerance on the specimens is plus 15 and minus 20 per cent.



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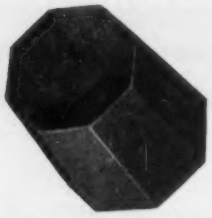
For nearly ¾ of a century HENDERSON BROS. has been helping manufacturers solve their Tumble Finishing problems with a wide variety of Tumbling Barrels . . . Sided Wood Barrels, Round Wood Barrels, Perforated, Cast Brass, Cast Iron, Welded Steel Barrels and Rubber Lined Barrels in the Tilt type and Horizontal Type for Bench and Floor installations. Where special processes call for special barrels, Hendersons is prepared to design and construct Tumbling Equipment to customer specification.

Write us, outlining your particular problem. Our Engineering and Development Service will be glad to make recommendations.

Perforated Tilting Barrel



Welded Steel Barrel-Polygonal

Since 1880 Designers and Builders of Tumbling Barrel Equipment.

THE HENDERSON BROS. COMPANY

135 S. LEONARD ST., WATERBURY, CONN.

The specifications for precision reference specimens refer to surface contour, material, accuracy, uniformity, and rating. The standard requires that roughness values of these specimens shall not vary from their designated values by more than plus or minus one microinch or plus or minus three per cent, whichever is the larger. For any given specimen of this type, the standard deviation of the peak heights shall not exceed five per cent of the nominal value of the height. This standard is a companion document to the American Standard Surface Roughness, Waviness, and Lay, B46.1-1947.

The American Society of Mechanical Engineers and the Society of Automotive Engineers sponsored the development of the standard under the procedures of the American Standards Association.

Chemical Treatment Destroys Rust and Phosphatizes Metals in One Operation

Octagon Process, Inc., Dept. MF, 15 Bank St., Staten Island 1, N. Y.

A new chemical treatment that removes rust, tarnish and light oil, chemically prepares metals for paint, and retards corrosion, is announced by the above firm. Known as Rustclean, the new compound destroys rust and rust-promoting surface contaminants, thereby retarding corrosion. Rustclean not only chemically cleans the surface of steel, iron, aluminum, zinc and cadmium, it also forms a phosphate coating which acts as a base for organic finishes. Rustclean is also an effective tarnish remover for copper and its alloys, it is claimed.

Several types of Rustclean are available, each designed for different work.

Rustclean 12 is designed for a wipe-on process for large parts or in plants whose equipment or production is limited. The best method of applying this compound is by sponge or brush. The concentrate is diluted with water; the amount of dilution is determined by the condition of the metal.

Rustclean 15 is a more concentrated compound which is used in an immersion process in a stainless steel vessel (recommended for use at elevated temperatures) or a tank lined with rubber, polyethylene or asphalt. It is most effective when used at a temperature above 160°F.

Rustclean is said to be safe to use. It contains a mild acid, which offers very little hazard to personnel. It hasn't the corrosive action of strong pickling compounds such as sulfuric, nitric and hydrochloric acids. It doesn't fume, or emit toxic vapors.

For close tolerance work, Rustclean is marketed in special grades. These inhibited types will remove rust without any attack on the steel, and will prevent hydrogen embrittlement, it is claimed.

Complete information is available by writing to the manufacturer.

BUSINESS ITEMS

Metal Finishing Moves to Westwood, N. J.

Our circulation, editorial and publishing offices have moved to 381 Broadway, Westwood, N. J. where a larger Exhibit of Finishes is now under construction. This conveniently located town in the northeastern corner of the State gives us a location in close proximity to our production facilities and all routes of transportation with ample parking space for visitors cars. Our offices and exhibit will be found in the bank building at the intersection of the two principal streets Westwood Ave. and Broadway. A cordial invitation to visit us is

exte led. The telephone is WEstwood 5-1530.

Robinson New Carborundum President

C. F. Robinson

The board of directors of *The Carborundum Co.* elected *Mr. Clinton F. Robinson* president and director of the company to succeed *Mr. H. K. Clark*, who resigned as President.

Messrs. *Paul B. Brown*, *Clarence E. Hawke*, and *William H. Wendel*, formerly Managers of the Bonded Products and Grain Div., Refractories Div., and Coated Products Div. respectively, were elected Vice-Presidents in charge of their divisions.

Willson New 3M Tech. Service Manager

Appointment of *G. G. Willson* as manager of the Technical Service section of the "3M" coated abrasives laboratory was announced this month

C. G. Willson

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TODAY for finishing ZINC, CADMIUM, ALUMINUM, CUPROUS METALS

WANT CORROSION RESISTANCE? Iridite will give you better-than-specification protection against corrosion.

WANT PAINT ADHERENCE? Iridite provides a firm and lasting base for paint by preventing under-film corrosion.

WANT EYE-APPEAL? Iridite can give you a variety of finishes, depending upon the metal being finished . . . from clear and sparkling bright or military olive drab, to attractive dyed colors.

BEST OF ALL, any Iridite finish is economical and easy to apply.

for example: IRIDITE® (AL-COAT) REDUCES NEED FOR ANODIZING

Simple chemical dip; immersion time only 10 seconds to 2 minutes; no sealing dip; color is clear or yellow depending upon your requirements; salt spray resistance equivalent to 20 to 30 minutes of anodizing, eliminates need for costly racks and electrical power.

WANT TO KNOW MORE? Write for literature and send production samples for free test processing. See "Plating Supplies" in your classified telephone directory or write direct.

Iridite is approved under government specifications.

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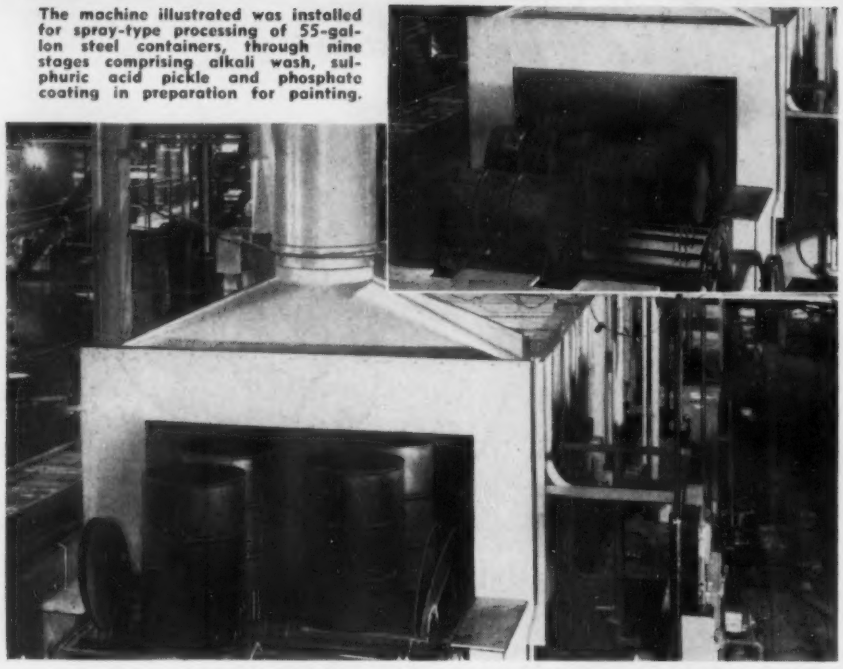
Manufacturers of Iridite Finishes
for Corrosion Protection and Paint Systems on Non-Ferrous Metals; ARP Plating Brighteners.
West Coast Licensee: L. H. BUTCHER COMPANY

continuous WASHING, PICKLING and PHOSPHATING MACHINES

The machine illustrated was installed for spray-type processing of 55-gallon steel containers, through nine stages comprising alkali wash, sulphuric acid pickle and phosphate coating in preparation for painting.



This is just one application of spray-type processing machines, the basic principle of which can be adapted to any product.

The important advantages of this type of machine include — All operations are complete in one machine — Greater safety since all operations are enclosed instead of being performed in open tanks with hazards from fumes, splashes, odors, etc. — A uniform product since all operations are more accurately controlled — A big saving in pickling time — Plus a big saving in costs.

WRITE FOR INFORMATION ADVISING PURPOSE FOR WHICH MACHINE IS DESIRED.

MORRISON INDUSTRIES, INC.
engineers & builders of industrial process equipment
furnaces • ovens • dryers • washers • pickling and plating machines • material handling systems • wire mill equipment • special production equipment
17700 BROADWAY • BEDFORD, OHIO

by *Minnesota Mining and Manufacturing Co.*, St. Paul, Minn.

Willson will be responsible for all technical service functions of the laboratory, as well as a technical training program recently instituted for selected 3M sales personnel.

Besides testing new laboratory developments in the field, the section is responsible for improving abrasive quality, tailoring the product for specific customer abrading jobs, and studying ideas originating through field contacts. The section's laboratory is maintained in St. Paul.

Willson joined the mineral research department of 3M's coated abrasives division in 1935; moved to the waterproof abrasives laboratory in 1942; and, has served as supervisor, technical service section, since 1948.

Buffalo Convention Makes a Profit

A recently-made-public report on the financial outcome of last year's Buffalo A.E.S. convention shows an excess of receipts over expenditures of $3,317.26. Of this $1,000 was retained by the Buffalo Branch and the balance turned over to the Supreme Society for future convention funds. Total receipts for the entire convention amounted to $22,492.00.

Cowles Honors E. S. Bassett

Mr. Edward S. Bassett, Secretary of *Cowles Chemical Co.*, was honored at a luncheon held at the Wade Park Manor Hotel in Cleveland, attended by all Cleveland employees of the company. He was presented a gold pin for thirty years of faithful and valuable service by *Mr. Robert F. Huntley*, Vice President and General Manager.

Mr. Bassett has been a director of

Mr. Robert F. Huntley is shown presenting gold pin to E. S. Bassett.

Cowles continuously since November, 1918. In 1926 he was appointed General Manager, and was elected President in 1930, in which capacity he served until 1938. He was Chairman of the Board until 1941, when that office was abolished and he became Secretary. In late years Mr. Bassett has been on a partially retired basis.

French Metal Finishing Supplier Visits America

Mr. Andre Waldberg, partner in the firm of *Waldberg Bros.*, of Paris, France, is now in the U. S. on a business trip. His purpose is to line up jobbing connections with plating equipment and supply manufacturers who are or would be interested in selling to the French market. Mr. Waldberg can be reached at Metal Finishing's office for the next several weeks. His home office in Paris is at 52 Ave. du President Wilson, Puteaux, Seine, Paris.

Topper Equip. Co. to Manufacture and Sell Circo Degreasers and Solvents

Announcement has been made by *Topper Equipment Co.*, Matawan, New Jersey, successor to the former Optimus Equipment Co., that it will carry on the manufacture and sale of Circo Vapor Degreasers, by which trade name Topper equipment will be known.

Vapor degreasers in a wide range of sizes are available to meet a variety of industrial and automotive metal parts cleaning operations.

The maker states that these are the only degreasers so designed that either trichlorethylene or perchlorethylene

degreasing solvents may be used. They reclaim their own solvent automatically.

The new models feature stainless steel construction, automatic controls, and solvent reservoir with built-in water separator. Constant solvent level control, packless flushing pump with hose, and large clean-out door are also featured in the new Circo models.

To meet the demands of the field for this type of equipment, a staff of experienced field sales and service representatives are located in practically all important industrial centers throughout the country.

Two improved types of degreasing solvents, Per-Solv (perchlorethylene) and Circo-Solv (trichlorethylene) for use with Circo and other types of Vapor Degreasers are available from stocks in strategically located warehouses.

Udylite Corporation Sponsors Junior Achievement Group

L. K. Lindahl, president, *The Udylite Corporation*, was host Monday, February 18th, at a dinner honoring *Luci-Craft*, the Junior Achievement company sponsored by Udylite. Udylite was the first firm in the Detroit area to sponsor a Junior Achievement group and continues to show an interest in this development of the business people of tomorrow.

Mr. Lindahl, *Clyde H. Reeme*, vice-president and treasurer, and *L. V. Vagle*, vice-president and sales manager, all gave brief addresses to the assemblage and Mr. Lindahl presented the group with their official Junior Achievement charter. Following this *Edith Zentrede*, president of Luci-Craft presented Mr. Lindahl with a plaque in appreciation of his counsel and sponsorship for their organization.

Oakite Moves to New Quarters

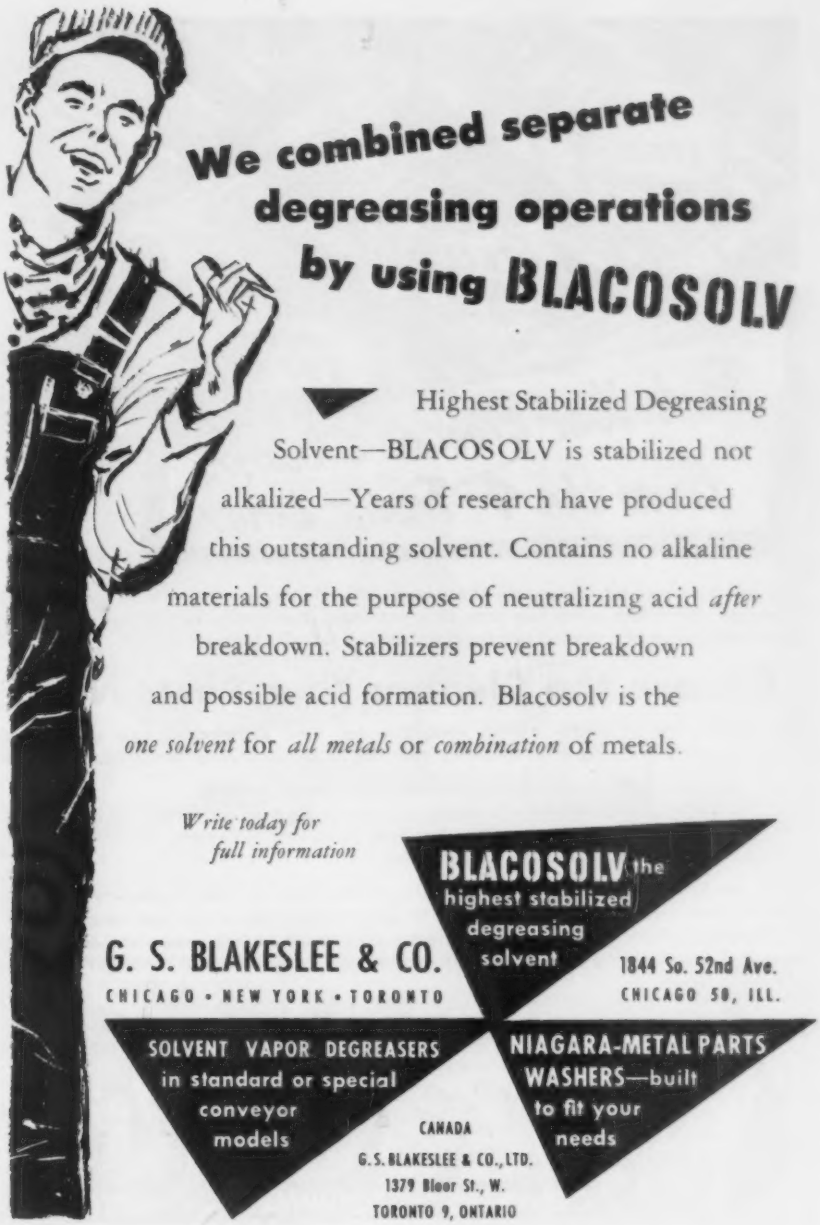
Oakite Products, Inc., manufacturers of specialized cleaning and allied materials, have announced the transfer of the company's general offices from 22 Thames Street to newer and larger quarters at *19 Rector St., New York 6, N. Y.*

Factors contributing to the move, which represents still another step in Oakite's continuing expansion program, have been the increased use of Oakite cleaning and related materials by industry and the steadily growing demand for technical advisory service and special research. Acquisition of the new office space will permit a substantial increase in the facilities of the Oakite Chemical Research and Engineering Laboratories, and is designed to assist the company in providing augmented technical advisory service to industry in connection with problems encountered in today's stepped-up civilian and defense production.

Lead Removed from Restricted Use List

Removal of all Government restrictions on the use of lead just announced by the N.P.A. resulted from substantially increased supplies of the metal now available to American consumers, according to a statement issued by the *Lead Industries Association*. Lead is the first common metal with widespread industrial applications to be thus freed by the Government.

Consumers may now proceed to use


We combined separate degreasing operations by using BLACOSOLV
Highest Stabilized Degreasing Solvent—BLACOSOLV is stabilized not alkalized—Years of research have produced this outstanding solvent. Contains no alkaline materials for the purpose of neutralizing acid *after* breakdown. Stabilizers prevent breakdown and possible acid formation. Blacosolv is the *one solvent* for *all metals* or *combination* of metals.
Write today for full information
BLACOSOLV the highest stabilized degreasing solvent
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SOLVENT VAPOR DEGREASERS in standard or special conveyor models
NIAGARA-METAL PARTS WASHERS—built to fit your needs
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The electro-cleaning compound that works effectively on steel would irretrievably damage soft metal parts like zinc or aluminum. A material suitable for steel and brass combinations would not be satisfactory for all steel pieces.

Choose the Cleaner Your Parts Need

The Magnus line of electro-cleaning compounds has been designed to meet each specific condition safely and efficiently. And they have the following essential properties in common:

1—Adequate Carrying Capacity for Required Current Densities.
2—Completely Adaptable to Anodic or Cathodic Cleaning—or Both.
3—Exceptionally Long Solution Life—Often Twice That of Ordinary Metals.
4—Concurrent Chemical Cleaning Action.

Tell us what parts you clean electrolytically. Then we can work with you in selecting the Magnus Cleaners best adapted to your needs. We'll be glad to make test runs on your various products in the Magnus laboratory so that you can see the exact results you can expect from each specific Magnus Electro-Cleaning Compound, with due attention paid to water conditions and other governing factors.

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Magnus
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all the lead they need for regular applications and may even employ it to relieve the strain on materials which are still scarce. In that way lead can help to maintain a more normal economy in this country.

In 1951 supplies in the United States were greatly reduced by the diversion of lead to foreign buyers because they were willing and able to pay prices in excess of the ceiling prices to which domestic consumers were required to adhere by the Government. Imports in 1951 were only 267,000 tons, less than half the 550,000 tons imported in 1950. However, having purchased heavily in 1951 and being faced with currency difficulties now, foreign buyers no longer are willing or able to pay high prices for lead. The foreign market has receded to a point where large quantities of foreign lead are now available for export to the United States.

In addition, the Association said, the import duty on lead was suspended effective Feb. 12, eliminating the two-price system which had worked a hardship on domestic consumers and bringing their costs of foreign and domestic lead together.

Meanwhile, production from domestic mines, hampered last year by labor shortages and strikes, is progressing at an accelerated pace. The third important source of lead, scrap, is also providing a greater supply than a year ago.

As a result, it is expected that total lead available in the United States may reach as much as 1,300,000 tons or about 150,000 tons more than a year ago. This quantity should take care of all requirements in this country without difficulty.

Consumption is difficult to estimate, the Association pointed out, particularly since Government military and stockpiling requirements are not clear and change from time to time. Nevertheless, lead is not a war metal to the same extent as some other metals and the defense program should not have the same heavy impact on its use.

Johnson to Head New Methods Div. for 3M Co.

Appointment of *S. L. Johnson* as manager of the New Methods Development division of the "3M" coated abrasives division was announced this month by *Minnesota Mining and Manufacturing Co.*, St. Paul, Minn.

Johnson will direct the new methods division in developing new machinery and techniques for conditioning carbon and alloy steels, and in developing improved methods for grinding and finishing other metals.

Typical of the division's work is its development of a more efficient method for grinding jet blades, thereby smoothing out a bottleneck that previously existed in jet aircraft production.

In addition to work in the field, the division operates a central new development laboratory in St. Paul, cooperating with 3M grinding-and-finishing laboratories in 14 cities from coast to coast.

Johnson joined 3M as a methods engineer in the coated abrasives division in 1943, and has served as super-

S. L. Johnson

visor, new methods division, since 1946.

Pangborn Appoints Buckley Assistant Sales Manager

Arthur J. Buckley

Pangborn Corp., Hagerstown, Md., manufacturer of blast cleaning and dust control equipment, announces the appointment of *Arthur J. Buckley* as assistant sales manager. For the past eleven years, Mr. Buckley was associated with the Harnischfeger Corp., Milwaukee, Wisconsin, in both home-office and field sales work.

Selenium Rectifier Meeting

Operation of selenium rectifier plants, which were on the verge of virtual shutdown in early February because of short supply of selenium, has been assured by an allocation of approximately 25,000 pounds for March, the National Production Authority, U. S. Department of Commerce, announced at the meeting of the Selenium Rectifier Stack Manufacturers Industry Advisory Committee.

February allocation was of 15,500 pounds, augmented by supplementary emergency allocations to avert plant closures.

NPA stressed three points about the increased allocations for March:

1. The larger quantity should *not* be considered a precedent for subsequent allocations. The increased amount is made possible by reducing producers' stocks, and including the third of production held back in February to build up inventories. An encouraging development, however, is that 1,500 pounds of March-allocated selenium comes from new producers.

2. March allocations, now being issued, will permit the purchase of selenium from any supplier. February allocations had specified the purchase source.

3. Selenium rectifier manufacturers may increase their March selenium supplies above allocations by imports and by selenium recovered from scrap, without inventory control. M-91, the selenium order, will be amended to that effect, NPA officials said.

Selenium for military requirements of rectifiers has been allocated at the rate of 100 per cent after screening, NPA said.

The remaining selenium supply for production of civilian and indirect defense-use rectifiers has been divided for March among rectifier manufacturers on the principle of 90 per cent of consumption during the base period (first half of 1950).

Committee members reported that a source of supply has been developed in recent months from selenium recovered from defective and scrap rectifier plates.

3M Co. Opens Boston Sales Office

Opening of a new Boston branch sales office and warehouse was announced by officials of *Minnesota Mining & Manufacturing Co.* recently.

The new building, a one-story structure featuring modern exterior and interior design, is located at 1330 Centre Street, Newton Center. Facilities include truck docks and railroad sidings.

Question!
How to Solve Your Thickness Problems?
Answer!
With the New KOCOUR Electronic Thickness Tester!
DETERMINES THE THICKNESS OF METALLIC COATINGS
BETTER! . . . FASTER! . . . EASIER! . . . CHEAPER!
The new KOCOUR ELECTRONIC THICKNESS TESTER is the answer to your thickness problems . . . QUICKLY and almost AUTOMATICALLY . . . this highly accurate instrument can determine the thickness of all the commonly plated metals on various base metals . . . thus putting an end to costly rejects and reworking.
KOCOUR'S NEW ELECTRONIC THICKNESS TESTER HAS THESE OUTSTANDING FEATURES:
● Set is self-contained.
● 90-95% accurate depending upon type and thickness of the plate.
● Average test requires only about 1 minute.
● Minimum thickness determined is 500,000's of an inch (5,000,000 for chromium).
● Maximum thickness determined is indefinite.
● Operates virtually automatically.
● Reads directly . . . no calculations necessary.
● Relatively insensitive to surface roughness.
● Compactly housed in portable metal cabinet, 17"x10"x10".
● Operates from 105-125 volt, 60 cycle, A.C. electric outlet.
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TILTING TUMBLING BARRELS

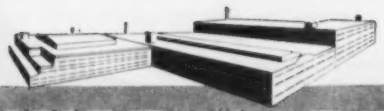
Available in Kiln-Dried Maple or Steel Shells

FINER FINISHES AT LOWEST COST. Today Globe Tumbling Barrels assure you increased production and finer, more economical finishes. Globe's exclusive work-shifting bottom gives six-way motion for greatest parts agitation to save finishing time and to give uniformly finer finishes to your parts. Low speeds for non-ferrous metals and plastics assure quality finishes with less spoilage.

Globe's direct motor drive is a space-saver for your shop, and its compact, rugged construction means years of dependable service.

FREE EXPERIMENTAL SERVICE

Like to cut finishing costs? Hupp's experimental laboratory will analyze your product finishing needs and make cost-saving recommendations. Send samples of your parts to be processed and a finished part. No charge or obligation. Write today!



Hupp Manufactures A Complete Line Of
Tumbling Barrels and Deburring Machines

HUPP CORPORATION

GLOBE STAMPING DIVISION

1250 WEST 76th STREET • CLEVELAND 2, OHIO

SERVING INDUSTRY SINCE 1902

W. M. Hobelsberger, Boston office manager, said the new unit is another link in 3M's nationwide expansion program aimed at improving service to industrial and retail customers across the country. The Boston branch serves New England.

Other branch officials who will headquarter in the new office are *J. H. Hargreaves*, abrasives sales manager for industrial and refinish trades; *A. S. Drew*, sales manager for general line tapes; *H. B. Kosanke*, sales manager for retail cellophane tape; and *J. E. Warner*, sales supervisor for "Scotchlite" Brand Reflective Sheeting.

The new warehouse also will stock adhesives and electrical tapes. Electrical tape sales will continue under the direction of *E. F. Gregg*, with headquarters in New York. *Howard Norman*, also of New York, is sales manager for adhesives.

Hardware maintenance sales of the Boston Branch are under the direction of *H. G. Kelley* of New York.

Hansen Heads Chicago Job Platers

Carl F. Hansen, President of *Advance Tinning Co.*, Chicago, has been elected Chairman of the *Chicago Electro-Platers Institute* at the association's 17th Annual Meeting. He succeeds *J. Robert Greenwell*, Chrome-Rite Co., also of Chicago.

Lawrence J. Hay, President of *Plating Service Co.* was elected Vice-Chairman, and *J. M. Westergaard*, partner, *Metal Processing Co.*, Secretary-Treasurer.

Elected to the Board of Directors were *John Lietz*, B. Mercil & Sons Plating Company; *Edward Fell*, Atlas Plating Works; *Robert L. Giesel*, Adolph Plating, Inc.; *Charles Jensen*, Jensen Plating Works; and *John Vermeyen*, Crescent Plating Works.

Carl F. Hansen

Continuing on the Board from 1951 are *J. Robert Greenwell; H. E. DeGrenier*, Grand Plating Co.; and *Emil Van Steen*, Modern Plating Co.

The Chicago Electro-Platers Institute, organized in 1935, has a membership of 92 companies in the custom electro-plating industry. These companies represent a large segment of the industry in northern Illinois and southern Wisconsin.

R. W. Pflug Named as Co-ordinator of Inquiries for Detrex

The appointment of *R. W. Pflug* to the post of Co-ordinator of Inquiries for the Industrial Sales Div. was announced by *W. F. Newbery*, Director of Sales for the *Detrex Corporation*, Detroit 32, Mich.

This new position will provide an efficient liaison between the company's field representatives and the engineering department. Mr. Pflug's 15 years of experience with Detrex in the sale and service of all types of industrial metal cleaning equipment will greatly increase the speed and effectiveness with which each customer inquiry can be processed.

Pflug's duties will include thorough analysis of each equipment request with regard to exactness of information and selection of the proper equip-

ment for the specific requirements of each customer.

Sigmund Cohn Firm Moves

Announcement was made recently of the moving of the *Sigmund Cohn Corp.*, to new quarters at *121 South Columbus Ave., Mount Vernon, N. Y.* The firm manufactures and sells precious metal plating salts and solutions, and was formerly located on Gold St., New York City.

Ten Years of Research Celebrated by Metal & Thermit

Woodbridge Research Laboratory of the *Metal & Thermit Corporation* celebrated its tenth anniversary with an open house on Saturday, March 1st.

High point of the occasion was the cutting of the birthday cake by *Dr. C. Kenneth Banks*, Vice-President of Research & Development.

The New Jersey Laboratory was designed and constructed for the specific purpose of Research and has been highly instrumental in Metal & Thermit's progress.

The company had been engaged in research before 1942 but these activities were carried out in plant laboratories. About 1940 the decision was made to centralize research and development activities and organize a separate research department.

Wyandotte District Managers Make Plans for Marketing 8 New Products

Highlight of a week's home office conference of Wyandotte Chemicals' 20 District Sales Managers was the co-ordination of marketing and promotional plans for introducing 8 new Wyandotte products in the next several months. Many of these new products will contain a Wyandotte "Pluronic"—Wyandotte's newly discovered family of surface active agents. Investigation and use of products containing the Pluronics show cleaning characteristics, speed and efficiency not formerly known in specialized cleaning products for industry, it is claimed.

The Wyandotte Pluronics were introduced to the district sales managers by *Robert L. Reeves*, general manager of the *J. B. Ford Div.* of Wyandotte Chemicals, and by *Dr. Thomas H. Vaughn*, vice president—research and development division of the corporation. President *Robert B. Semple*, in his banquet address, announced that a new and larger Pluronics plant will

NOPCO 1067-A

★ saves over 30% sulfuric acid solution in pickling of iron, steel and nonferrous metal products

★ aids processing

★ speeds production

★ assures improved output

Add Nopco 1067-A to the pickling bath, and you reduce loss of sulfuric acid solution through carryover to the rinsing tank by 30% to 40%.

Here's a definite economy, of outstanding benefit today when current restrictions limit the use of sulfuric acid.

But Nopco 1067-A not only effects high drainage, it also affords such important advantages as these:

★ ***faster, deeper, and more uniform penetration of oxide scale—resulting in elimination of pitting, lower metal losses, and smooth, clean surfaces after pickling***

★ ***reduced operating time and lower costs—since better drain-off means fewer rinsings for complete acid removal***

★ ***reduced acid contamination in operations following pickling—with the result that tool and die life is increased***

★ ***easier acid disposal—since acid is localized in first tanks***

In a word, addition of this unique surface tension depressant to your sulfuric acid pickling solutions not only means *money in your pocket*, but more satisfactory products coming off your production line.

LET US TELL YOU ALL ABOUT NOPCO 1067-A. MAIL THE ATTACHED COUPON TODAY.

NOPCO EVOLVED THRU RESEARCH

NOPCO CHEMICAL COMPANY
Harrison, N. J.

BRANCHES: Boston • Chicago Cedartown, Ga. • Richmond, Calif.

Nopco Chemical Company ——Dept. M
Harrison, New Jersey

Gentlemen:
Please send me full information about Nopco 1067-A.

Name_____
Firm_____
Address_____
City_____ Zone____ State____

Wyandotte Chemicals District Managers make plans for marketing 8 new products. (Front row)—A. J. Bettelheim, New York; Gail Eldridge, Kansas City; P. S. Spencer, San Francisco; Fred H. Tholen, sales manager; C. E. Smith, administrative assistant to Mr. Reeves; Robert L. Reeves, general manager, J. B. Ford Division; Ford Ballantyne, Jr., vice-president of the corporation assigned to J. B. Ford Division; Tom Jones, Atlanta; Tom McCormick, Detroit and Jack Munshaw, Winnipeg. (Second row)—G. Millard Whitney, Syracuse; Fred Troxell, Cleveland; Evans Schmeling, Cincinnati; Carl Dover, Minneapolis; Howard Hastedt, Chicago; Collins Hewett, Dallas; M. E. Powers, Boston; W. C. VanKeuren, Philadelphia; Tom Todd, Los Angeles; Paul Pariseau, Pacific General; Terence Neill, Montreal; L. A. Wagner, Seattle; Robert Tucker, St. Louis and Harry Flister, Pittsburgh.

ARE YOU CHEATING YOURSELF...

out of brighter, finer zinc and cadmium plating at lower cost by not trying the new ARP Plating Brighteners in your own plant? If you've not tried them call in your Iridite field engineer today for test samples. Or, write direct to

ALLIED RESEARCH PRODUCTS
INCORPORATED
4004-06 E. MONUMENT STREET • BALTIMORE 5, MD.

REPRESENTATIVES IN PRINCIPAL INDUSTRIAL CITIES; West Coast: L. H. BUTCHER COMPANY

Manufacturers of Iridite Finishes for Corrosion Resistance and Paint Systems for Non-Ferrous Metals; ARP Plating Chemicals.

be an important part of the company's extensive expansion plans for 1952 and that Wyandotte Pluronics will play an ever-increasing part in the Ford Division marketing schedules. Mr. Semple also announced the full-time assignment of *Ford Ballantyne, Jr.*, vice president, to the Ford Division activities of the company.

Silver Plated Flatware and Hollow Ware Meeting

Establishment of a termination date for placing allotments of controlled materials, after which date unused allotments would be forfeited and the material redistributed, was recommended recently to the National Production Authority, U. S. Dept. of Commerce.

Members of the *Silver Plated Flatware and Hollow Ware Industry Advisory Committee* suggested that such a regulation would result in full use of brass mill capacity which, they said, is opening up.

Restrictions on copper, aluminum and nickel have resulted in unemployment ranging upwards from 25 per cent, manufacturers said.

Defense orders, averaging about 10 per cent of productive capacity, are insufficient to take up the employment slack. Such orders include such items as aircraft engine blades, machine gun clips, land mines and electronic devices, as well as stainless steel flatware for military use.

NPA recognizes the dependence of the silver plated flatware and hollow ware industry upon brass and aluminum and the conservation efforts made by the industry, officials said. Experiments of one company with a carbon steel base for its plated hollow ware were reported as unproductive so far.

The industry is concentrated in New England and New York areas in which employment opportunity in other trades is very limited, manufacturers pointed out. Several stated they have shifted production to lines on which hand work predominates, as an expedient to retain their labor.

The allotment of copper for production of silver plated hollow ware (coffee pots, sugar bowls and like articles) initially was at the rate of ten per cent of base period use in the first quarter, later raised to 25 per cent, and 30 per cent for the second quarter. For aluminum the allotment initially was 20 per cent raised to 25 per cent in the first quarter, and 25 per cent for the second. Steel allotment was at 50 per cent of base for both quarters.

Flatware (knives, forks, spoons, etc.) allotments were for 50 per cent of steel in both quarters, 35 per cent of copper-base alloy in the first quarter and 30 per cent in the second.

Taylor Named Purchasing Agent for Diversey

Fletcher B. Taylor, formerly assistant purchasing director, has been named purchasing director of *The Diversey Corp.*, Chicago.

Diversey manufactures and sells cleaners, disinfectants and insecticides for food plant, industrial and institutional sanitary maintenance; cleaners used in preparing metal surfaces for

F. B. Taylor

finishing operations, and milled clays for refining vegetable, animal and mineral oils.

Gilwood New Research Director for Permutit

M. E. Gilwood

Effective immediately, the position and responsibilities of *Martin E. Gilwood* are those of Director of Research, *The Permutit Company*, New York, N. Y.

Mr. Gilwood, a graduate Chemical Engineer from Rensselaer Polytechnic Institute, Troy, N. Y., is eminently qualified for his new duties, having risen in successive steps from the positions of Research Engineer to Assistant Manager of Research to Manager of Chemical Research and finally to Director of Research.

He will be responsible for all operations of Permutit's Research, Analytical and Pilot Plant Laboratories at Birmingham, N. J., and for Market Research activities from his office in New York.

Kraft Chemical Forms Plating Division

Gerald G. Kraft, of *The Kraft Chemical Co.*, 917 West 18th Street, Chicago, announces the formation of the *Kaynide Division* to better serve the needs of the metal finishing industry. This new division will be devoted exclusively to the plating, heat treating and allied metal finishing industries, and will take over the sale and warehousing of chemicals, anodes, processes, equipment and plating supplies, formerly sold by the Kraft Chemical Co.

Recognizing the need of the metal finishing industries for "up-to-the-minute" information on current government rules and regulations, the Kaynide Div. has established a department specially trained to keep its customers informed of changes in the government price control set-up and its effect on the plating industry.

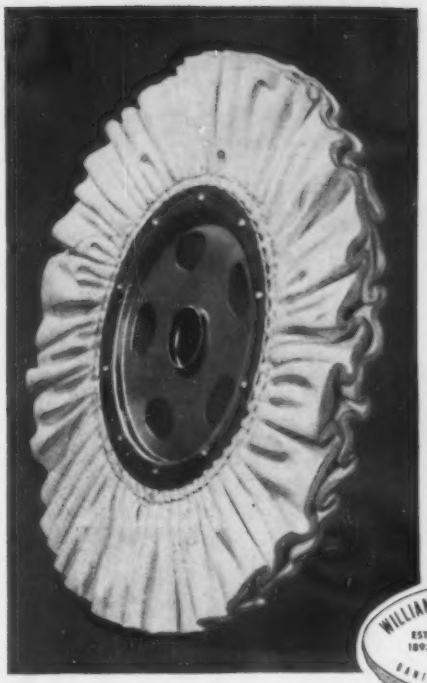
Through its technically trained staff, the Kaynide Div. will be in a position to install any size plating process. Many new items to be handled by the Kaynide Division include white brass anodes and the Kaynide bright copper process.

Udylite to Build New Research Center

The *Udylite Corporation* will start construction of a research laboratory building on a 23-acre site on Hoover Avenue near Eight Mile Road as soon as weather conditions permit, *L. K. Lindahl*, president announced recently.

The new building is the first unit of a long term building project which will eventually house all of Udylite's manufacturing and administrative operations, Mr. Lindahl said.

Designed to provide complete facilities for every phase of research on electroplating and metal finishing processes, the structure will cover 16,000 square feet in area. It will be a one story, contemporary-design building and will be of steel frame construction with a pre-cast cement slab roof, brick and stone masonry walls and aluminum sash. Interior walls will be finished in glazed tile with metal and glass partitions.



Meet the New

Cool-Running Cost-Cutting

CUTMASTER

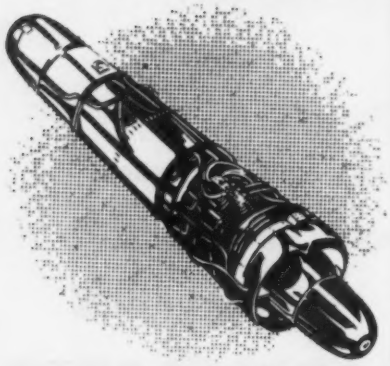
for Automatic Buffing!

WILLIAMSVILLE BUFF DIVISION EST 1893 A1 ® DANIELSON CONNECTICUT

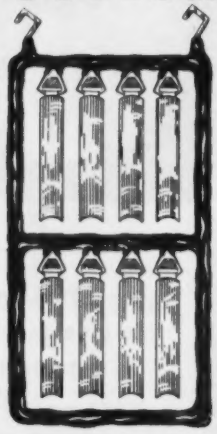
Williamsville's new CUTMASTER is engineered to give extra work-hours of cool-running performance on automatic buffing jobs. Note the bias cut for long wear — the steel center perforated to insure coolness — the designing for perfect balance. Get the full story now — write, wire, or phone!

WILLIAMSVILLE BUFF DIVISION
The Bullard Clark Company
DANIELSON, CONNECTICUT

another NARACO *first*



for Jet PRODUCTION



Precision built plating racks for turbine blades and a complete line of fixtures to hold other jet parts. Latest Naraco engineering can give you the exact plating rack to handle any of the following specialized processes:

ANODIZING
MANODIZING
ELECTRIC ETCHING
HARD CHROME
COPPER OR BRONZE

Profit with Naraco experience — Consult their factory nearest you on any of your defense problems.

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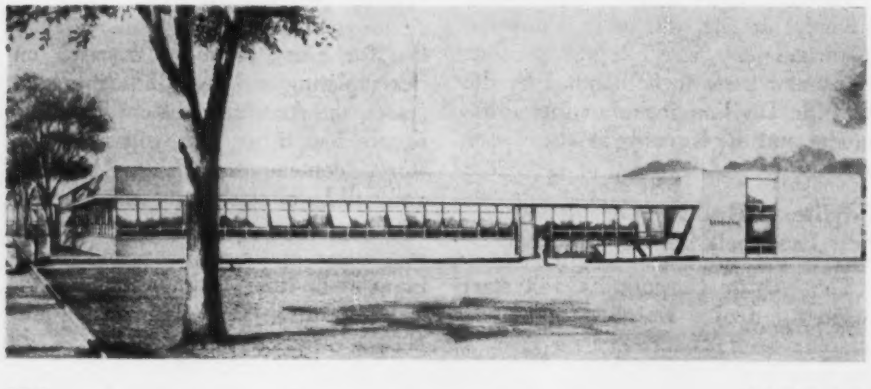
4632 West 21st Pl. CICERO, ILL.

NATIONAL RACK CO., INC.
179-181 Madison Street PATERSON, N. J.

IMPERIAL PLATING RACK CO.
1613 Industrial Avenue FLINT, MICH.

Air conditioning will be installed in the office, laboratory and library sections. The heating will be provided by a boiler located in the research building, pending construction of a powerhouse to serve the entire project. It will be a "split-system" type with convectors at window locations and tempering coils in fresh air intakes. Plumbing, heat and exhaust ducts will be located in below-floor access trenches or in duct space above ceiling level. The lighting throughout will be recessed fluorescent except in the pilot plating rooms and storage areas where it will be fluorescent but suspended from the ceiling.



Cadmium in December 1951

Primary and secondary metallic cadmium production in December was 8 per cent above the November output, according to the *Bureau of Mines*. Total production for the month was 726,195 pounds compared with 674,218 pounds in November. The average monthly production in 1951 was 685,725 pounds; in 1950 it was 749,664.

Stocks of metal maintained by metal producers continued to increase, totaling 939,952 pounds on December 31 compared with ending stocks of 890,869 pounds in November. Compound producers' stocks of metal also rose—from 219,192 pounds on November 30 to 225,512 pounds at the year's end.

There were no imports of metallic cadmium during December; imports of metal have been negligible since April. Imports of cadmium contained in flue dust declined to 98,342 pounds, less than half of the quantity imported during the previous month. Exports of metal increased to 127,188 pounds compared with 58,502 pounds in November.

New Facilities Added by American Agile

The American Agile Corp., fabricators of Agilene (Polyethylene) and Agilide (Hard Polyvinyl Chloride) products, announces the completion of a new 12,500 sq. ft. building.

Located at 5461 Dunham Road, Maple Heights, O., (Mailing address P.O. Box 168, Bedford, O.) the expanded production facilities permit the manufacture of a complete range of standard and custom-built corrosion resistant bottles, containers, tanks and tank liners, pipe lines, equipment, and other high-grade thermoplastic and thermosetting materials for the chemical and allied industries.

New Barrel Finishing Equipment Firm Formed

The Mecha-Finish Corp., of Sturgis, Mich., are now manufacturing a complete line of equipment and supplies for all types of barrel finishing. They have installed a customer sample processing department, and are ready to work out customers barrel finishing problems and recommend procedures. Officers of the firm are *D. G. Hopkins*,

Pres. & Gen'l. Mgr.; *D. W. Hoxie*, Vice-Pres.; *F. M. Snyder*, Sec'y.

Belke Establishes Training Program with Northwestern University

The Technological Institute of *Northwestern University*, Evanston, Ill., and the *Belke Manufacturing Co.*, Chicago, announce that starting in September, 1952, a co-operative relationship will be established between the University and the Company with the purpose of training better qualified men for the Electroplating and Metal Finishing Industry.

The co-operative program will comprise twelve (12) school quarters during which various courses in the Chemical, Mechanical and Electrical Engineering Departments of the University will be studied. These courses are Analytic Geometry, Calculus, General and Physical Chemistry, Quantitative Analysis, Physics, Metallurgy, Heat Treating, Engineering Drawing, Machine Design, Social Sciences, and others to complete the requirements for a degree.

Interspersed with these twelve (12) quarters of scholastic work will be six (6) quarters of actual employment in the plant of the Belke Manufacturing Co., manufacturers of metal finishing equipment, in various co-operating plating shops, and in manufacturing plants with large metal finishing departments.

On completion of the five-year course the students will be awarded a degree of Bachelor of Science in Engineering.

Under the co-operative program students will attend classes in the University for the first year and a half, after which they will alternate between school and industry on a three-month basis, some attending classes while others work in the co-operating plants. While working in industry, students will be paid prevailing wage rates for the jobs held.

The Belke Manufacturing Co. will make several full-time tuitional scholarships available, so that these students on scholarships will be virtually self-supporting after the first year and a half of their college work.

To be eligible for enrollment in the program, a student must have finished in the upper quarter of his high school graduating class and must successfully pass the usual requirements for admission to the Technological Institute of Northwestern University.

For further information relative to the program, write *Raymond W. Kotz*, Belke Manufacturing Co., 947 North Cicero Avenue, Chicago, Ill.

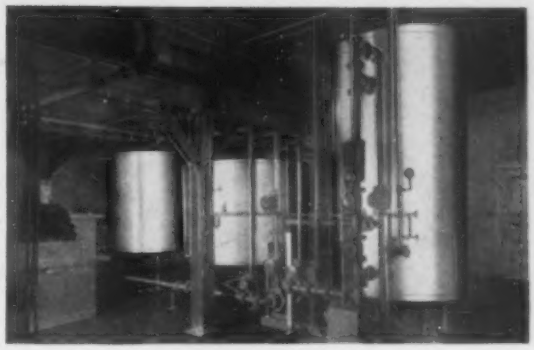
The Technological Institute of Northwestern University occupies this beautiful building on the shores of Lake Michigan. Overall University daytime enrollment is about 10,000 students and approximately 2,000 faculty members.

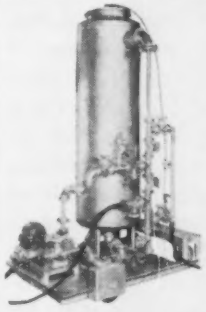
Moehle Appointed National Accounts Manager for Detrex

P. W. Moehle has been appointed Sales Manager of National Accounts for the *Detrex Corporation*, Detroit 32, Michigan. The announcement was

CHROMIC ACID PURIFIED AND RECLAIMED by ionXchange

NEWEST ILLCO-WAY development in ionXchange is seen at the right—a specially engineered Chrome Purifier installation to purify and reclaim chromic acid used in anodizing and hard-chrome plating in a U. S. Government plant. (Below is shown a portable unit—for use in plants where anodizing tanks are widely separated)...In anodizing, the Chrome Purifier eliminates the necessity of discarding chromic acid which is normally replaced with fresh acid to maintain a required pH and acid concentration. Contamination of the anodizing solution is kept at a minimum when processed by the ILLCO-WAY method. With clean solutions, voltage requirements are decreased and an anodic film is produced having very high resistance to the salt spray test, which on production samples shows an average life of 1000 hours. The new ILLCO-WAY Chrome Purifier permits recovery of contaminated chrome plating baths which must otherwise be discarded. Clear solutions produced by the ILLCO-WAY method reduce current requirements, and provide uniform plating resulting in fewer rejects .... Rinse waters containing chromic acid solutions can be recovered with an ILLCO-WAY Chrome Purifier and Evaporator.

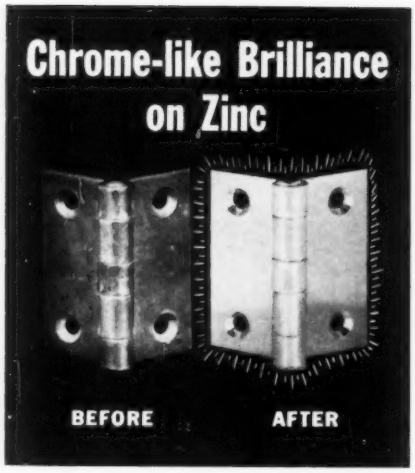




Pure chromic acid can be recovered from your anodizing baths...plating and rinse waters can be reclaimed and recirculated...easily, economically...with this newest of ILLCO-WAY developments in ionXchange engineering. The ILLCO-WAY Chrome Purifier is available in four standard (for permanent installation) and in portable models (for treatment of several solutions located throughout a plant). Write for equipment details.

ILLINOIS WATER TREATMENT CO.
856-4 Cedar Street, Rockford, Illinois
141 E. 44th St., New York City

ILLCO-WAY



LUSTER-ON®

makes the difference

At less than 1/5¢ per square foot you can have brilliant finishes like this with Luster-on Utility bright dip for zinc. It's easy to apply and control and there's plenty available — no shortages. Every day former users of nickel and cadmium are converting to this passivating bright dip.

CHECK LIST

Do you produce parts like those listed below? Then you can obtain corrosion-resistant, brilliant finishes at lowest costs with Luster-on Utility 15 or 25.

- Cabinet Hardware
- Small Tools (wrenches, etc.)
- Auto Body Parts
- Bathroom Hardware
- Aircraft Metal Parts
- Wire Goods
- Refrigerator Shelves
- Radio Speakers, Chassis, Shields
- Television Parts
- Electrical Parts
- Air Conditioning Fans, Guards, etc.
- Bolts, Nuts, Washers, etc.
- Builders' Hardware
- Outdoor Metal Articles (fences, trailers, etc.)

Also

Protective Finishes
Khaki Drab Luster-on

With 300 hours of salt spray resistance Luster-on Khaki Drab far exceeds U. S. Government Specifications of 96 to 100 hours. This chromate type conversion coating has been developed primarily for electro-deposited zinc plate. It is also ideal as a paint bonding treatment for later organic finishes.

SEND SAMPLES

Send us samples of your parts. Let us zinc-plate and LUSTER-ON treat them for you — at No Charge. This will show you how you can dress up and protect your product simply and inexpensively with Luster-on.

THE *Chemical* CORPORATION
58 Waltham Ave., Springfield 9, Mass.

P. W. Moehle

made by *W. F. Newbery*, Director of Sales.

During the past 15 years Mr. Moehle has advanced through the positions of Industrial Sales Representative, Divisional Manager of the company's Ohio, Indiana, and Kentucky areas and Assistant Sales Manager of the Drycleaning Division. Later he was appointed Assistant National Accounts Manager and served in this capacity in the Detroit metropolitan district for several years before being named to his present post.

Mr. Moehle's broad experience in the sale and service of metal cleaning process equipment and chemicals will enable him to serve all national account customers thoroughly and efficiently.

Galvanizers Committee to Meet in St. Louis

The Galvanizers Committee, which is sponsored by the *American Zinc Institute*, will hold its twenty-seventh meeting in St. Louis, Missouri, on April 21-22, 1952, according to Chairman *J. T. Mayhew*, of Weirton Steel Co.

R. J. Stoker, Superintendent of Galvanizing at the Gary, Ind. plant of U. S. Steel Co., heads the program committee for the occasion, which will be held at the Hotel Statler coincidentally with the annual meeting of the American Zinc Institute.

McAdams Joins Mazia Consultants

John P. McAdams, who has for the last four years served as a mechanical engineer for the Munitions Board, is now employed by the firm of *Joseph Mazia*, Consulting Engineers, Washington, D. C.

A native of the District of Columbia, Mr. McAdams attended Central High School, George Washington Univ. and Catholic Univ. of America, all located in Washington, D. C. He first worked for the Naval Gun Factory beginning in 1939 as a designer in the field of Naval Ordnance. After duty with the United States Coast Guard he began work for the Secretary of the Navy in 1946 with the Office of Naval Material as a Mechanical Engineer. With the establishment of the Unification Act he joined the staff of the Secretary of Defense and has since been concerned with the problems of armed forces

John P. McAdams

materiel standardization in the major fields of tools, refrigeration and conveying equipment.

He is a member of the Washington Society of Engineers and the Engineers Club of Washington. As a Lieutenant in the Naval Reserve he is a member of the Volunteer Ordnance Unit at the Navy Department, and also maintains active membership in the United States Coast Guard Auxiliary.

PATENTS

(*Continued from page* 88)

Electrostripping Plated Coatings

U. S. Patent 2,578,898. *Henry G. Orlik, Camden, N. J., assignor to Radio Corporation of America.*

A method of stripping a coating metal of the class consisting of nickel, copper, chromium, zinc, cadmium, tin, and silver from an underlying metal of the class consisting of brass, zinc base castings, aluminum, and steel which comprises making the metal part to be stripped the anode in a solution consisting essentially of about 64

to about 90 per cent orthophosphoric acid, about 5 to about 14 per cent acetic acid, and about 5 to about 24 per cent water, all percentages being by weight, and passing an electrical current through said solution until a desired amount of said coating metal has been removed.

Cam-Controlled Polishing Machine

U. S. Patent 2,581,157. *F. R. Whitcomb.*

Apparatus of the class described comprising a pair of movable supports, an abrading roll on each support, floating hydraulic cylinder and piston means respectively connected to the supports to move the latter toward and away from each other, a valve controlling the cylinder and piston to determine the spacing of the supports, a moving cam, and a cam follower therefor connected to the valve to control the latter and thereby cause the supports and abrading rolls to move toward and away from each other according to the cam contour.

Back-Up Wheel for Polishing

U. S. Patent 2,581,270. *E. N. McVey.*

A back-up wheel for an abrasive belt and the like comprising a pair of axially spaced, substantially radially rigid circular side plates, a plurality of substantially rigid back-up bars extending between said side plates adjacent their peripheries and removably supported on said plates in circumferentially spaced relation, and a resilient covering surrounding each said backup bar and projecting radially outwardly of the peripheries of said side plates.

OBITUARY

ROBERT PISCATOR

It is with deep regret that we announce the death of Mr. Robert Piscator, founder and manager of the Ideal Manufacturing Co., manufacturers of buffing and polishing compounds, of Indianapolis, Ind.

Mr. Piscator's death was attributed to a heart attack. He had been active in the polishing industry during his entire lifetime, and was one of the first subscribers to METAL FINISHING in the early days of the finishing industry.

KOLD-GRIP Polishing Wheel Cement, laboratory-controlled through every step of production, will arrive at your plant *ready for use!* Viscosity is constant, regardless of normal temperature variations and the cement can be applied directly from the container . . . *without mixing or heating.* Kold-Grip is clean, odorless and very easy to handle.

Coarse or fine-grain abrasives set up right for fast cutting efficiency. Substantial savings are effected through longer over-all wheel life, fewer setups and reduced wheel inventory.

Wheels dry rapidly, are unaffected by humidity changes, and may be stored in any convenient plant area.

Let our polishing engineer demonstrate Kold-Grip for you, or send for free sample, telling us the metal to be polished, grain sizes to be used, and drying facilities available. We can help you if we hear from you.

• Liquid and Solid Carburizers • Cyanide, Neutral, and High Speed Steel Salts • Coke • Lead Pot Carbon • Charcoal • No Carb • Carbon Preventer • Quenching and Tempering Oils • Drawing Salts • Metal Cleaners • Kold-Grip Polishing Wheel Cement

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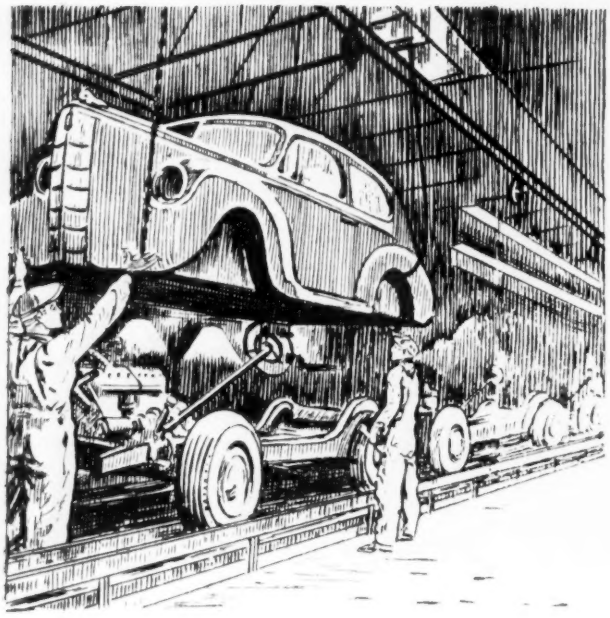
COMING EVENTS OF THE A. E. S.

Boston Branch
Annual Educational Session and Banquet
April 19
Statler Hotel — Boston, Mass.

Indianapolis Branch
Annual Educational Session and Banquet
April 26
Indianapolis Athletic Club — Indianapolis, Ind.

Milwaukee Branch
Annual Educational Session and Banquet
April 26
Schroeder Hotel — Milwaukee, Wisc.



MOTOR CITY PLATING NEWS

by

Edward Finne

Emmett Heads New Products Department of Detrex

The creation of a New Products Department and the appointment of *John P. Emmett* as its head have been announced by *A. O. Thalacker*, Vice-President and General Manager of *Detrex Corporation*, Detroit 32, Michigan.

The urgent need for the formation of such a department has resulted from the company's extensive research program and increased activity in new product development. Recent new product and process developments have come from the company's Industrial, Food Processing and Drycleaning Divisions.

LUSTRE ↔ SEAL

THE NEW DISCOVERY — A TRIPLE ACTION COMPOUND

1. **CUTTING**
   Rapidly removes polishing lines from both soft and hard metals.
2. **COLORING**
   Produces a lustre unobtainable with ordinary coloring compounds.
3. **SEALING THE SURFACE**
   Seals surface pores for greatly increased corrosion protection.

Easily removed in ordinary cleaning cycles for subsequent plating.

Make Us Prove It On Your Production Problem. Send Samples

DETROIT CHEMICAL SPECIALTIES CO.

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John P. Emmett

Mr. Emmett will handle the market research and sales development of all new products while they are in the pre-marketing phases. The company's program of market expansion, under Mr. Emmett, will involve the acquisition of raw materials in the manufacture of future product developments, as well as the expansion of plant facilities. New uses for existing products and problems of foreign trade will be some of the responsibilities of this department.

During the six years Mr. Emmett has been with Detrex, he has gained broad experience in the sale and service of the company's industrial cleaning equipment and chemicals. He also served as Assistant Sales Manager of the Drycleaning Division.

****

Conn Polishing Co. announce the opening of their plant and office at 20836 Lyndon Avenue, Detroit. The company is equipped with complete facilities for job polishing and buffing, according to *Sam J. Conn*, owner.

****

Plater's Testing Service, 17344 Beaverland, Detroit 19 have opened a new chemical laboratory devoted primarily to the plating industry. The laboratory is equipped to handle any type of plating problem, including control analysis, trouble shooting, service and research.

Walter Katz and *Steve Eisner* are the instigators of the service and they are both chemists with M.S. degrees who are working for their Ph.D. They claim a total of twelve years of theoretical and practical plating experience.

Edgar Hauser, president of the *Metalplate Co., Inc.* of Birmingham, Ala. spent several days in Detroit in late February investigating processes and machinery necessary to plate primer percussion tubes for ordnance shells.

We had the extreme plasure of his company for two days and were able, we hope, to help him with some of his problems. His earnestness and thirst for knowledge impressed us very much and our best wishes for his continued success in the South go with him.

****

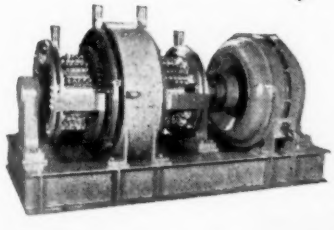
Gordon O. Rice has been appointed general sales manager of the *Oakman Manufacturing Co.*, 12995 Hillview, Detroit.

Rice has been sales manager of the Parker Wolverine Division of the Udylite Corp. since 1945. Previously, he had been employed in sales capacities at Parker for 15 years.

Oakman Mfg., makers of automotive stampings, has recently completed a second plant at 6600 E. Nine Mile Road, Van Dyke for their press work. To plate their products, Oakman recently purchased the Nine Mile Road

COLUMBIA

MOTOR GENERATORS



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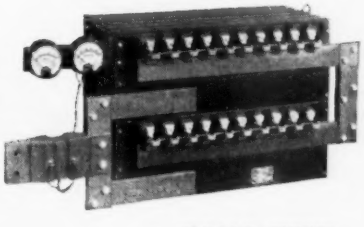

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• TONG TEST AMMETERS

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Metal Cleaners for all purposes.

Honite Brand—Barrels, Finishing Chips, Compounds, Equipment for the Barrel Burnishing and Deburring Trade.

Specialized Tumbling Engineering Service

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plant of the *Advance Plating Co.* of Detroit.

****

Detrex Advances Two in Engineering Department

The appointment of *John Nuber* as Assistant Chief Engineer and *Stewart Millar* as Supervisor of Engineering Standards and Development has been announced by *T. J. Kearney*, Chief Engineer of *Detrex Corp.*, Detroit 32, Michigan.

Mr. Nuber will be in charge of all technical phases of design and estimating for the company's industrial process cleaning division, which includes the solvent-vapor degreasers and alkali washer equipment.

Mr. Millar, a graduate of the University of Detroit Engineering College, previously served with Detrex in the capacity of Field Service Engineer. His new duties as Supervisor of Standards and Developments will concern him with design improvement of present industrial cleaning equipment, together with continuous study of ways and means of improving the design of accessory equipment for Detrex metal cleaning machines.

Associations and Societies

AMERICAN ELECTROPLATERS' SOCIETY

New Haven Branch Hears Ackerman

Mr. Arnold Ackerman, Research Director for the *Anderson Oil Co.*, of Portland, Conn., addressed the Feb. 12 meeting of the New Haven Branch of the AES on the subject "Rust Preventatives." To illustrate the various points brought out in his talk Mr. Ackerman carried out some chemical demonstrations for his audience. The speakers' long experience in this field enabled him to give his listeners a fact-packed evening and some new slants on this important subject.

A.E.S. Headquarters Moves to Newark, N. J.

D. Gardner Foulke, Executive Secretary of the A.E.S., announced recently that the new executive offices of the Society have been moved from their former location in Jenkintown, Pa., to a new location in the American Building, *445 Broad St., Newark, N. J.* All correspondence should be sent to the new address.

Milwaukee Branch Annual Educational Session

The Milwaukee Branch of the AES will hold its Annual Educational Meeting and Banquet on Saturday, April 26, 1952, at the Schroeder Hotel.

The Educational Meeting will start at 2:00 p.m. and will consist of the following papers:

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Practical Products for Practical People

1. "*Full Automatic Barrel Plating*," by Mr. A. H. Kirkpatrick, of *Frederic B. Stevens, Inc.*

2. "*Full Automatic Plating*," by Mr. Martvig J. Moll, of the *Hanson-Van Winkle-Munning Co.*

3. "Subject to be announced later," by L. R. Davidson of the *Grav-i-Flo Corp.*

The Dinner Party will start at 7:00 p.m. and includes an excellent floor show, followed by dancing until 1:00 a.m.

This year, the Milwaukee Branch will have table reservations, thus assuring our members and guests seating accommodations in advance.

Indianapolis Branch Annual Educational Session

The Indianapolis Branch will hold its 9th Annual Educational Session & Dinner Dance at Indianapolis Athletic Club, April 26th.

Educational Session at 1:30 P.M. with the following speakers:

Mr. W. Binai, of Binai & Binai, Indianapolis, Ind.; Subject, "*Plating with Insoluble Anodes.*"

Mr. S. O'Connor, of Western Electric, Indianapolis; Subject, "*Plating Room Waste Disposal.*"

Mr. R. A. Fellows, of Udylite Co., Detroit Mich.; Subject, "*White Brass Plating.*"

The dinner will start at 6:30 P.M., followed by a floor show and dance.

Tickets are $7.00 per person, which can be obtained by writing *R. Bruck*, Treasurer c/o *Platers Supply Co.*, 2311 Valley Ave., Indianapolis 18.

Hotel Reservations can be obtained by writing *Mr. L. Fisher*, 31 E. 45th St., Indianapolis, Ind.

Pittsburgh Branch

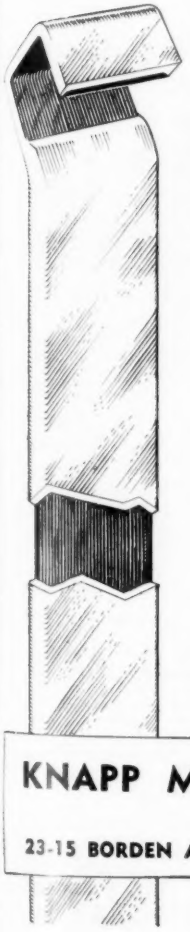
The Pittsburgh Branch of the AES held its meeting on February 14, at the Sheraton Hotel in downtown Pittsburgh. Fifteen (15) members enjoyed a delicious ham dinner while there were approximately forty (40) present at the business meeting. The officers of the Branch and the chairmen of various committees made their reports. Progress of several pending projects was discussed briefly on the floor.

Two new applications for membership were presented and approved for further action. The applicants were *Donald W. McGiffin*, of Standard Steel Spring, and *Bernard Noel*, of Wyandotte Chemicals.

Plans for the Annual Banquet are progressing at a rapid pace. The celebration will be held at the Mona Lisa Lounge, Brownsville Rd. and Route 51, Whitehall, Pittsburgh, on Saturday April 19. A tempting steak dinner has been ordered and afterwards we will be entertained by *Slim Bryant* and his orchestra of radio and TV fame.

The subject of a Pittsburgh Branch exhibit at our Chicago Convention was discussed by the embership and several constructive suggestions were made. *Bill Hennessey*, Philadelphia Branch, made the suggestion that "Tin Plating" be emphasized in a display. Pittsburgh is the world's center of electrolytic tin plating and he thought that it would be quite appropriate that the word "Pittsburgh" could be formed from tin plated letters. A committee was named to decide on this issue and report at our next meeting.

It was the unanimous opinion that the Research Program is very benefi-



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A NEW AND REVOLUTIONARY DEVELOPMENT

Electro-Cupralum Anodes are manufactured by combining copper and lead through a Homogeneous Extrusion Process whereby the two metals are chemically and inseparably bonded together.

The resultant product consists of a full width *continuous* copper electrode with a Homogeneous lead covering on all sides except the underside of the copper hook.

FEATURES

1. Ten times the electrical conductivity of any Lead Anode.
2. Faster, better plating.
3. Even distribution of current through solution.
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5. Tenacious, insoluble coatings.
6. No build-up of temperature.
7. Periodic cleaning unnecessary.

Electro-Cupralum Anodes are *superior* because they combine the *superior* conductivity of copper with the *superior* protection of lead.

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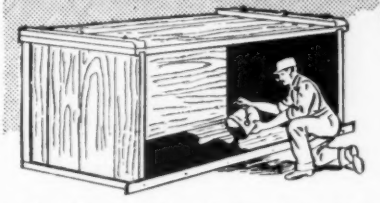
Easy to Apply RUBBERITE TANK LINING



Just heat to 300°F and pour

Provides a lasting lining that withstands acids and caustics at room temperatures. A standby of Platers for over 25 years. Effectively protects wood or steel tanks. Easily applied in your own shop—just turn tank on side and fasten board on edge as illustrated. Then heat Belke Rubberite to 300° F. and pour over surface. Surfaces to be coated require no special preparation but should be reasonably clean.

When Rubberite cools, it has characteristics similar to soft rubber. Will not crack, scale, or run in the hottest weather. Write for complete information.

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947 North Cicero Ave.
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EVERYTHING FOR PLATING PLANTS

cial to us all and in view of this fact, our annual contribution will again consist of $125.00.

Our Librarian then introduced the speaker of the evening, *Dr. J. E. Stareck*, of United Chromium. The subject which he chose to speak on was conversion coatings. The present defense program has augmented the use of both dip and electrolytic coatings and Dr. Stareck elaborated on the comparative properties of all the more popular finishes. The lecture was followed by a lively discussion in which many of the members present presented their own problems or aired their own experiences. The meeting was then brought to a close.

Indianapolis Branch

The February meeting was held at the usual place, Fox Steak House, with 35 members present for steak dinner. There were 53 members present for the meeting at 8:00 p.m. This was the largest turnout of this branch.

The speaker of the evening, *Mr. M. M. Beckwith*, of *Harshaw Chemical Co.*, and member of the branch, spoke on the subject of "*Fluoborate Plating Solutions.*"

The fluoborate baths are more complex than usual baths; however, everything can be done with them that can be plated with regular baths with several advantages, such as higher current densities, heavier deposits, etc. Tanks must be lined with Koroseal, rubber or Neoprene; rubber piping or Carpenter No. 20 or Durimet or Worthite is also satisfactory. Karbate Heaters are O.K., and carbon must be of the GA type. Organics and silica impurities will cause laminations in the plated parts. As for addition agents, nothing has been advanced in this line in the last 15 years. The best addition agent is glue.

The lead bath is very simple to operate and is used extensively for shell plating. The lead will withstand corrosion much better than any plating because the pin holes will seal themselves by act of corrosion.

Cadmium fluoborate offers two advantages: a minimum of twice the plating speed of cyanide baths, and elimination of hydrogen embrittlement. It is not suitable for decorative purposes. In zinc baths, cast iron can be plated in Fluoborate solutions quickly and easily, with 3 times the current density of other baths.

Fluoborate iron bath does not offer much other than plating stereotypes. Lead & tin baths are used for bond between shell and subsequent plate.

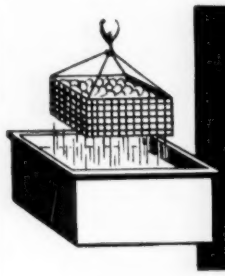
Countinous filtration is essential; use wood pulp and not silica base materials. Iron contaminations is very hard to remove, but can be done by dunnying out at 1-10 a.s.f.

Fluoboric acid is no more dangerous than any other acid used in plating procedure.

Elected to membership were, *Mr. F. Liffick, Mr. F. Thomason, Mr. M. M. Trook, Mr. J. R. Greene* and *Mr. F. E. Cannon.*

Cincinnati Branch

Another large turnout of members of the Cincinnati Branch of the AES was on hand for the monthly meeting February 27, 1952, at the Engineering Society Headquarters. An overflow crowd enjoyed the usual tasty supper after which President *Robert D. Miller* called the business portion of the meeting to order. The Secretary read letters from the Cleveland and Indian-



CUT DOWN ACID CONSUMPTION with ACTIVOL #1321

The addition of a small amount of ACTIVOL #1321 to the acid bath assures quick and maximum drain-back of acid from pickled parts into the bath reducing carryover acid loss as high as 40% in many cases. ACTIVOL #1321 is effective with all acids, mineral and organic, in baths up to 40% concentration by weight of acid. (For higher concentrations of acid, use ACTIVOL # 1357). Subsequent rinsing is materially improved by having less acid actually carried into the rinse than previously. In addition ACTIVOL accelerates the action of the acid in the pickle bath without affecting the performance of any inhibitor that is used.

ACTIVOL #1321 is recommended for use for such operations as pickling, anodizing, galvanizing, plating and wire drawing, etc.

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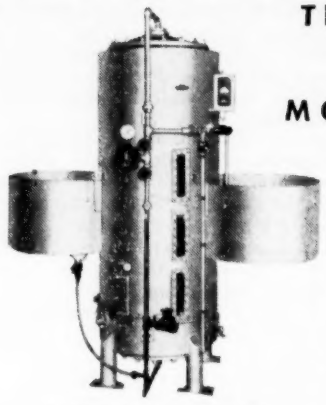
CHEMICALLY PURE WATER

For Plating Solutions & Hot Water Rinses

THE LOW COST* Penfield MONO-BED WAY



Operating on the most efficient dionizing technique known (intimately mixed cation and anion resins in a single unit tank), raw water passes through a Penfield Mono-bed Demineralizer only once, *yet comes out with resistances reported as high as 20,000,000 ohms.* No heat or steam power is ever required, and regeneration of resins is accomplished by simple gravity and displacement

*COSTS LESS, OPERATES FOR ONLY PENNIES

Yes, it usually costs less than 15c per 1000 gallons to eliminate unwanted precipitates and hot water rinse stains the Penfield "Planned Purity" way. Write today for new catalog showing Penfield Demineralizers with flow rates from 10 to 10,000 gph.

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Specially fabricated to suit your individual requirements by Penfield's Tank Fabricating and Lining Division. Write today for complete details.

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apolis Branches announcing their Regional Meetings, a financial report on the Buffalo Convention last year was given, with the Branch enthusiastically noting the presence of a surplus, after which the membership application of *Elmer Kokenge* was presented and unanimously accepted.

Ray Barry, Chairman of the Picnic Committee reported on the difficulty in obtaining a golf club for our annual outing in June but promised to try and secure a suitable course for recreation for all.

Stewart Chipman and *Clarence Spears* were appointed a Nominating Committee with the former acting as Chairman.

K. P. Bellinger, Vice-President and General Manager, *The Chemical Corp.*, Springfield, Mass. was introduced as the speaker, taking as his subject, "*Conversion Coatings on Zinc and Cadmium.*" He opened his talk by discussion of the bright treatment of various metals and the passivity resulting there from, and then stressed the fact that the proper cleaning of metal and right plating will assure good results with any first class coating.

He then pointed out that zinc was not hard enough—even with a lacquer coating—for complete conversion in the automobile industry even in the present shortage of so many critical materials. Stating that a cyanide zinc bath is of primary concern, Mr. Bellinger said that zinc and cadmium are excellent protection media but warned that there are many uses to which zinc cannot be put due to the fact that it has poor bearing surfaces. Particularly in a marine atmosphere he remarked that cadmium was far superior to zinc.

The speaker then discussed various methods for zinc plated baths and advised that there were liable to be more impurities in a new bath than an old one. The use of sodium sulphide will eliminate such impurities.

After showing samples of a new salt-proof material made of a resin fibre glass bond for use in tanks and duct work, Mr. Bellinger conducted a spirited question and answer period.

The Buckeye Products Co., Cincinnati, acted as host for the usual Social Hour which successfully concluded the evening.

New York Branch Annual Banquet

The annual banquet and technical session of the New York Branch was held at the Statler Hotel on Feb. 16th. Over 200 attended the afternoon technical talks, with close to 500 present in the evening for the banquet and entertainment.

Speakers of the afternoon were *Dr. Soderberg*, Editor of "Plating" magazine, who first discussed some of the editorial problems of the Society publication, then followed with a discussion of the fundamentals of zinc plating. *Dr. Louis Weisberg* talked about the newer developments in plating waste disposal, giving an example of a new plant where recovery of chromic acid is paying for the installation in a short time, and where recovery of the cyanide for re-use is above 98%. *Dr. Saltonstall*, of Udylite, completed the program with a general talk on plating room layout and maintenance problems. *Lionel DeWaltoff*, librarian of the N. Y. Branch, acted as Technical Session Chairman.

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1,000 TIMES FASTER

ELIMINATES PITTING and ROUGH DEPOSITS

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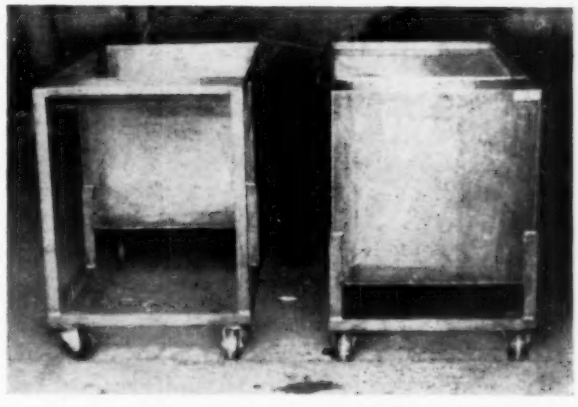

Accessories by STORTS

ILLUSTRATED are two units from a large order of mobile tanks equipped with slanting shelves, for draining batches of material in process. These are typical of the high-utility special fabrications, designed for use in connection with metal finishing, that are being Stortswelded for long-life service.

STORTS WELDING COMPANY INCORPORATED

38 Stone Street MERIDEN, CONN.

Manufacturers of Welded Fabrications to Specification

Baltimore-Washington Branch

The February 12th meeting of the branch was held at the Park Plaza Hotel in Baltimore. The meeting opened with President *Lamb* conducting a business session. At about 9:30 the business was still unfinished, so business was adjourned till after the speaker for the evening had presented his topic. *Mr. William Enright*, of the *Automotive Rubber Co.*, Detroit, gave the inside dope on "*Diaphragming in the Electroplating Industry.*" His topic was most interesting and very well received. Discussion on the subject then ensued but the boys couldn't shake Mr. Enright in his facts and findings.

Following this presentation the business meeting was resumed and carried on for quite some while.

CAN YOU HELP?

Information is being sought of the whereabouts of *Ralph Nelson* on behalf of his family, whom he has failed to contact since February 1950. This man was born in Wisconsin on May 14, 1912. He is about 6 ft. tall, weighs about 170 lbs., has sandy hair, brown eyes, tattoo on right arm, worked as an electro-plater. Anyone aware of his present location is requested to communicate with the *National Desertion Bureau*, 105 Nassau St., New York 38, N. Y.

METAL FINISHING SUPPLIERS' ASSOCIATION, INC.

February Board Meeting

The Board of Directors met in executive session the full day, Saturday, February 2nd, at the University Club, New York City. All the officers were present.

Much satisfaction was derived from the responses to our letter of January 14th, requesting an advance dues payment to finance our general operating fund and for the many friendly, cooperative and thought stimulating letters that accompanied the replies containing checks. It was the opinion of those gathered that the annual dues structure for 1951-1952, to be fair and reasonable, should be based on an elective schedule, (a choose-your-own-class basis) of business intensity and coverage whereby concerns with purely local activities should pay $25; those with regional status, $50; and those operating on a national or international scale, $100. This was also the convergent trend in the thinking of the mounting membership as reflected in their answers to our solicitation and it was, therefore, agreed that this plan should be tried out to determine if it will prove adequate for the needs of the organization, and until more budgetary information can be acquired and compiled.

Chairmen were appointed to ten Standing Committees and they, in turn, will tap the abounding resource of competent men in this industry available to us for candidates willing to serve with them.

Mention is made again of the fact that copies of our Certificate of Incorporation and By-Laws will be prepared for distribution to the membership as soon as possible, so that you will have them well before the next annual meeting.

The Board is extremely cost conscious and mailings of these communications are regularly made at appreciable

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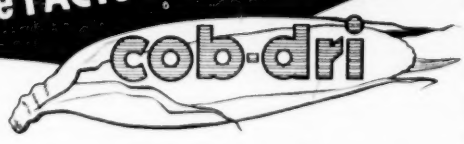

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CHEMICALS AND HEADACHES
IN YOUR BRIGHT ZINC PLATING WITH

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TRADE MARK REG'D.

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Cuts immersion time and quantity of bright dip chemicals consumed.

INSURES UNINTERRUPTED CONSTANT BRIGHT ZINC PLATING THRU CONSTANT SOLUTION PURIFICATION.

Effectively cleanses your zinc solution of copper, cadmium, lead, tin, mercury, and like contaminations as fast as they get into your electrolyte either from the anodes, work, or external sources.

Prevents harmful accumulation of carbonates.

No filtering required. No waiting period. Economical.

ORDER A 15-GALLON DRUM — $42.75 — ON 30 DAYS' APPROVAL

Sulphur Products Co. Inc.
Greensburg 7, Pa.

Bright zinc may replace your present nickel-chrome finish.

expense to 955 concerns appearing on our eligible list. If you are not interested in receiving these letters further, will you please advise us, and if you are, will you co-operate by informing us to whom in your organization they should be directed, so as to receive continued attention.

At Buffalo, the membership of the International Fellowship Club by unanimous vote commissioned its officers to take legal steps to have the organization incorporated under State law and to change its name to Metal Finishing Suppliers Ass'n., Inc. This having been done, it should be noted that the new organization expects to observe the attendant request of the membership to identify the hospitality functions of the society such as the Fellowship Luncheon, and the Annual Open House Party, regularly held at Annual Conventions, by happy association with the good, old IFC name.

At the invitation of its President, *Mr. C. F. Nixon*, Secretaries and Delegates from all the branches of the American Electroplaters Society were called to convene for a Special Meeting with the Executive Board of the Supreme Society at the Benjamin Franklin Hotel in Philadelphia, from 10:00 A.M. to 7:00 P.M., February 9th, for a discussion of the National Society's problems and aims.

Time was allotted in the agenda for officials of several related organizations to be heard, and your President took the occasion, in his remarks, to remind the representatives of the many ways in which the members of MFSA each year assist the AES financially through memberships of their Research Committee, sponsorships of national and local affairs, subscriptions, contributions and other devices, and he remonstrated with the delegates against the unreasonable number of requests for funds sent to members of the MFSA for one function or another from the local branches.

The delegates were asked to apprise their various groups of this situation and to correct this practice as much as possible.

In a poll conducted late in 1950 and recorded early last year under the direction of past President *George L. Nankervis*, our membership very definitely expressed the feeling that the registration fees charged at AES Conventions should be sufficiently high to cover substantially the entire cost of the Convention, and this information was transmitted to the Officers of the Supreme Society of the AES.

The Committee of the AES that last year managed the Buffalo convention proved that this could be done, and the income did equal the expenses, leaving sponsorship contributions as clear profit.

The 1952 Chicago Convention Committee has decided in advance that the registration fees will cover all expenses, and there will be no solicitation of funds for this purpose. They have, furthermore, informed us, that contrary to previous practice all prizes for the Annual Ladies' Plato Party will be purchased by the Committee rather than be obtained gratuitously from our membership.

Senator *John Sparkman* of Alabama, Chairman of the Select Committee on Small Business, in co-operating with the NPA Electro-plating Advisory Committee about whom we wrote you on December 28th, 1951, has sent letters to a number of our members,

NEW! TUMBLER-MIXER

$99.50
F.O.B. Cleveland
Without Tumbling Barrel

A LARGE TUMBLER at a SMALL PRICE!

ATTACHABLE STEEL BURRING BARREL as illustrated $42.50

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Universal — Portable Unit Saves Time, Space, Expense — Tumbles Solids or Mixes Liquids — Tilts through 90°.

Adaptable to many uses due to adjustable turntable clamps that allow standard or odd-shaped containers to be used. Easy to hold 5-gallon pail, wooden box, can, jug, stone jar, etc. Various other barrel attachments available.
SPECIFICATIONS — Anti-Friction Bearings — Automatic Belt Tightener — 19" Diameter turntable — 1/6 H.P. 110 volt A.C. single-phase motor — Weight 80 pounds—barrel extra.

Write for complete information.

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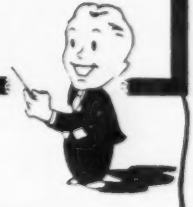

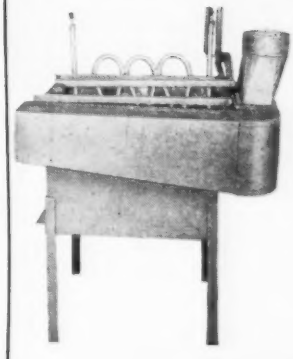

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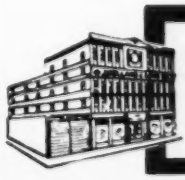

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asking for pertinent selling information to determine the accuracy of certain claims under investigation.

The significant paragraph in Senator Sparkman's letter runs as follows: "Complaints have also been coming to this Committee that small platers are losing business to large manufacturing concerns which are establishing their own plating facilities for defense work while existing facilities are adequate to perform this work. There would seem to be no excuse for this practice."

It is unnecessary to comment on the possible concussion to this industry of any ill-advised legislation or regulation consequent on a lethargic attitude on the part of our membership to rectify the apparent misunderstandings, and the MFSA has taken issue with the position of the Committee in this matter. It is anticipated that individual members contacted by the Committee will present their own views, but it would prove helpful in the aggregate, if they would communicate them as well to our Secretary so as to strengthen and round out our case.

THE ELECTROCHEMICAL SOCIETY

50th Anniversary and Philadelphia Convention

The Electrochemical Society will celebrate its 50th Anniversary by returning to its birthplace in Philadelphia, May 4 through 8, 1952, for the spring meeting at the Benjamin Franklin Hotel. The Society's first meeting was held in Philadelphia in April, 1902.

This year over 125 technical papers have been scheduled for the meeting, which promises to be the largest in the Society's history. Subjects to be covered at the sessions include: Electric Insulation, Electrothermics, Instrumentation, Luminescence, Rare Metals, Screen Application, and Theoretical Electrochemistry.

An added feature on the technical program will be a special round-table discussion on "The Teaching of Electrochemistry."

Meetings of various committees, a plant trip to the American Telephone and Telegraph Co., and a full social program will complete the extensive plans for the convention.

Manufacturers' Literature

Metal Conveyor Belts

Ashworth Bros., Dept. MF, 306 Shrewsbury St., Worcester 4, Mass.

This firm has just published a new catalogue giving complete information on their extensive line of metal conveyor belts. It covers the range of applications, designs, maintenance, drives and take-ups, wire specifications, and many other pertinent topics. The firm emphasizes throughout its book the specialized technical service rendered all its customers, which they believe is essential to satisfactory performance of metal conveyor belts.

Copies of this helpful catalogue may be obtained by writing to the above address.

Buffs and Polishing Wheels

F. L. and J. C. Codman Co., Dept. MF, Rockland, Mass.

This firm, one of the oldest and

DAYBRITE

First in Acid Copper

Let DAYBRITE solve your COPPER PLATING problems. Check these important, money-saving items:

- ✓ Low Conversion and Operating Costs
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- ✓ Ideal As Undercoat For Chromium After Color Buff or Brite Dip.

DAYBRITE is time tested and proven. Write now for new technical bulletin giving full details.

DAYTON BRIGHT COPPER CO.

1030 Valley St. Dayton 4, Ohio

Cut corners on Weld Blending!

Here's how one man and a Haskins Flexible Shaft Machine can help you cut corners—save money on your weld blending operations:

—Because you handle only a light handpiece—not a heavy motor—Haskins equipment makes fast work of the roughest welded joints—at surprisingly low labor costs.

—Heavy-duty power permits sustained operations—more work units per hour.

—Higher speed grinding means a smoother joint—for better appearance, less strain at the seam.

—Full line of accessories includes drum and disc sanding heads for finishing welds on flat surfaces, corners, fillets—wherever a fine seam is required.

There's a unit to meet your specific needs . . . do your job faster and more economically. Your choice of mounting—bench, pedestal or overhead—in a wide power range. Write today for complete details and prices. R. G. Haskins Co., 607 S. Washtenaw Ave., Chicago 12, Ill.

largest firms in the buff and wheel making field, has issued a handsome new catalog illustrating the many types of buffs and wheels in their line. Codman buffs feature the "non-fray" feature, which is claimed to give greatly extended buffing life. In addition to the pleated style buffs, the firm also manufactures conventional buffs in every style of sewing, and polishing wheels in various densities, sizes, and arbor holes. A copy of this illustrated booklet should be in your files for quick reference. Write to the above address.

Chemical Treatment for Oil-Retaining Rustproof Surface

Octagon Proceses, Inc., Dept. MF, 15 Bank St., Staten Island 1, N. Y.

Rustshield 2, a chemical treatment that produces an oil-retaining rustproof surface for moving metal parts, is described in a new 4-page publication by the above firm.

Attractively printed in two colors, the booklet discusses application methods and advantages of using Rustshield 2 on sliding and bearing surfaces. A great variety of precision parts and defense components are given the Rustshield treatment to meet U. S. Army Ordnance Specification 57-0-2C, Type II, Class A, and Military Specification MIL-C-16232 (Ships), Type I.

Blackening Processes

Swift Industrial Chemical Co., Dept. MF, Canton, Conn.

A bulletin recently published by this firm describes their line of "Activanium Blended" blackening compounds for ferrous base metals. Nu-Black, Ultra-Black, and Gamma-Black are the names of the three types of advanced and balanced blackening baths whose operation and applications are described in the folder.

In addition to blackening salts, this firm also has a line of heat treating salts, metal cleaners, and rust-resisting compounds. Copies of the bulletin are free on request.

Resin-Bonded Fiberglas Products

The Chemical Corp., Dept. MF, Waltham St., Springfield 9, Mass.

What at first started out as a new type of light, strong, and chemically resistant new material for plating tanks has now been adapted to such other anti-corrosive uses as pipe, vent hoods, ducts, trucks for handling wet chemicals, plating barrels, and tank linings. All of these items can now be molded of one-piece resin-impregnated fiberglas that shows excellent resistance to a wide variety of chemicals and solvents. As a replacement for stainless steel, rubber covered steel, vitreous ware and other scarce or high priced materials, this material is being widely adapted in industrial applications.

Bulletins describing these various items are available by writing to the above address on company letterhead.

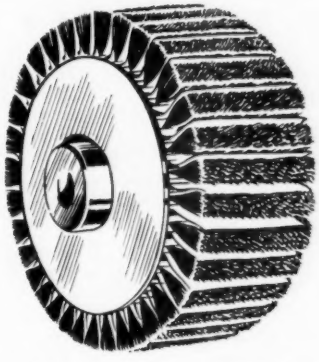
Protective Plastic Paint

Corrosite Corp., Dept. MF, 405 Lexington Ave., Chrysler Bldg., N. Y. 17, N. Y.

A new bulletin describing the characteristics, applications, and methods of use of the tough, corrosion resistant Corrosite protective plastic paint is now available from the above manufacturer.

Pointing out how Corrosite "protects where other coatings fail" against marine atmospheres, tropical

THIS MAY BE THE ANSWER TO YOUR FINISHING PROBLEM!



We say this because the Vonnegut Brush-Backed Polishing Head is designed especially for polishing curved and formed surfaces . . . and because it is an excellent deburring tool. It is used directly on die casting metals, aluminum, brass, bronze and steel — but it is equally efficient for removing bubbles and other blemishes and feathering out such areas on enamelled or painted surfaces. Its basic versatility is enhanced by a wide choice in grade and grit of abrasive loadings. It's a unique device available in two models, for portable tools or fixed spindle operation. Write for the Vonnegut Polishing Head bulletins.

VONNEGUT MOULDER CORPORATION

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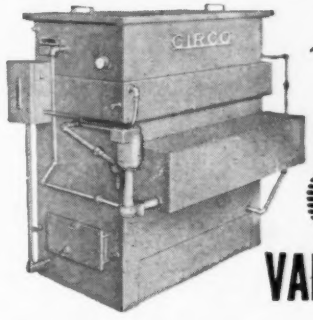
SAVE TIME MANPOWER with CIRCO VAPOR DEGREASERS



You can save *dollars* on your cleaning operations by installing CIRCO Vapor Degreaser in your production line. With its use metal parts cleaning is speeded up and made more efficient. Grease, oil and dirt are quickly and effectively removed from the parts by the vapors of the solvent. Chips, insoluble impurities, buffing compounds and stubborn dirt are completely removed with clean solvent flushing. Maintenance and operation costs are at a minimum. Solvent is distilled and reclaimed *automatically*.

CIRCO VAPOR DEGREASERS available in all types, vapor, vapor-immersion, vapor-spray and combinations. All sizes from small batch-type degreasers to custom-built monorail or cross-rod conveyor models.

WRITE FOR — *complete catalog*

Use PER-SOLV or CIRCO-SOLV for all Vapor Degreasing requirements

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TOPPER EQUIPMENT COMPANY

MATAWAN, NEW JERSEY • OFFICES IN PRINCIPAL CITIES

MANUFACTURERS OF VAPOR DEGREASERS AND METAL PARTS CLEANING EQUIPMENT

climates, chemical attack, abrasive action, salt water corrosion and other similar conditions, the 8-page bulletin explains the Corrosite systems for painting metals, concrete, brick, stone, plaster and asbestos board. It describes methods of applying the paint and outlines uses in a variety of industries, including railroads, chemical processing, food and dairy, public utilities, petroleum, and marine fields.

Copies may be obtained from The Corrosite Corporation. Request bulletin No. 201.

Electrolytic Motor-Generators

The Electric Products Co., Dept. MF, 1725 Clarkstone Rd., Cleveland 12, O.

Bulletin 20-210 describes in 14 pages with 43 illustrations a complete line of low-voltage, direct-current motor-generators for electrolytic processes. Not only are both sleeve-bearing and ball-bearing constructions presented, but also a short history of the development of todays electrolytic motor-generators and several electroplating fundamentals. Write for your copy.

Abrasive Belt Machines

Porter-Cable Machine Co., Dept. MF, Syracuse 8, N. Y.

A catalogue issued by this firm recently is a collection of case histories showing how and where abrasive belt polishing and grinding has saved time and money in all types of manufacturing plants. Details of before and after results are given, with photographs illustrating the methods used. The operations run the whole range of platen, contact wheel, formed wheel, centerless, and flexible belt polishing. Jigs and fixtures are also shown for special grinding jobs. Copies of this very informative catalogue may be obtained from the above address.

Floors for Plating Rooms

The U. S. Stoneware Co., Dept. MF, Akron 9, O.

"*How to Build Corrosion Resistant Floors*" describes in detail how to construct acid-proof brick floors. The new bulletin describes the uses of acid brick, the application of different types of cement, shows detailed drawings of various types of floors, as well as actual installation photos. This book is designed for and directed to the engineers and construction men who are faced with corrosion resistant flooring problems. Complete installation instructions, and answers to typical questions on flooring is also covered in this new 16 page, 2 color bulletin.

Sisalin Sections for Combined Buffing and Polishing

Hanson-Van Winkle-Munning Co., Dept. MF, Matawan, N. J.

The above firm offers to the plating industry a new two-color bulletin on Sisalin Sections for *both* buffing and polishing. Sisalin sections, available with special stiffening impregnation for added cutting properties, can be combined to form wheels of any desired thickness.

The bulletin tells how sisalin sections of unbleached muslin and sisal can be used for eight different polishing and buffing operations; gives diameters, thicknesses and sewing specifications; and includes field preformance information.

Concluding the brochure is a page

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IMMEDIATE SHIPMENT FROM STOCK

QUALITY BRAND PUMICE
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GUARANTEED • BRAND NEW
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ONLY $150 EACH
Regular Price $214.95
MODEL NO. N106 6 Volt 100 ampere full wave rectifier with output condenser to give positive DC at all times. Input single phase 110 Volt can be plugged directly into light socket. Stepless control from zero to full voltage. Electro magnet overload relay shuts off instantly. Fully guaranteed for 6 months.
Offer expires May 15 subject to prior sales. (no jobber discounts)

You save $64.95 on every unit if you act now. ORDER TODAY!
SPECIAL CHEMICALS CORP. 30 Irving Place (Dept. MF) New York 3, N. Y.

SPEED-UP your nickel stripping with STRIPODE
PROTECT the base metal
A proved addition agent, STRIPODE strips nickel plate faster and protects the base metal from pitting, roughening and etching. Also saves on use of acid, eliminates need of sand blasting or heavy buffing operation. Try it!
ORDER A TRIAL GALLON!
THE CHEMICAL CORPORATION
54 Waltham Avenue
SPRINGFIELD • MASSACHUSETTS

illustrating other Hanson-Van Winkle-Munning plating equipment and supplies—automatic plating conveyors, polishing barrels, rectifiers and controls, motor generator sets, brushes, buffing and polishing lathes, multiple plating barrel units, centrifugal dryers, compositions, etc.

For copies of the brochure—"Sisalin Sections," Bulletin SS-100—write to the above address.

Cloth-Bag Dust Collectors

Pangborn Corp., Dept. MF, Hagerstown, Md.

This firm offers an eight-page bulletin on its new cloth-bag dust collector for carbon black, cork, fine wood, graphite, pigments, lime, soap, metal oxides and similar dusts.

Illustrated by 12 photos the bulletin tells how the cloth-bag collectors work, and how they are installed and maintained. It also gives specifications of standard collector sizes and dimensions.

Further, the brochure describes collector casings, hoppers, hopper valves and structural supports. It also shows how to mount and flush the collector for the various types of disposal—roof, wheel barrow, car, truck.

Wire Brushes

Dixon & Rippel, Inc., Dept. MF, 479-483 Hasbrouck Ave., Kingston, N. Y.

Dixon & Rippel, Inc., brush manufacturers, have a new catalog ready for distribution. Over 50 illustrations help show their complete line of fine wire scratch brushes for use by the metal finishing industries. Copies may be obtained by writing them on your letterhead.

Rubber-Lined Equipment

Broadway Rubber Corp., Dept. MF, 529 E. Broadway, Louisville 2, Ky.

Just off the press is a highly interesting and informative catalog from *Acme-Fisher Div.*, Broadway Rubber Corp.

The book contains 14 pages of technical and general information of interest to industrial firms who have problems of corrosion in equipment.

A copy will be sent free on request.

News from California

By Fred A. Herr

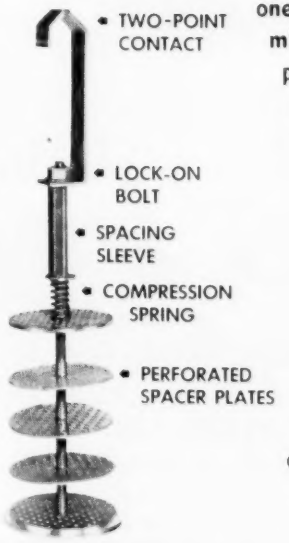
United Lead Construction Corp., of Kearney, N. J., has opened a branch office at 3510 East 14th Street, Los Angeles, with Vice-president *John Whitney* as branch manager and *Rhys. N. Ricky* as engineering technician. The firm manufactures anodes, fabricates lead-lined tanks, installs heating and cooling coils, and offers lead burners on a 24 hour service schedule. Lead sheeting for protection against X-ray and atomic radiation is also supplied.

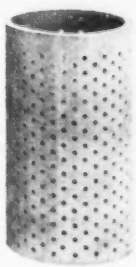
E. A. Vermere, formerly active in Southern California as operator of a plant for manufacturing and electrolytically polishing plumbing parts, and during recent years owner of *Vermere Corp.*, at Malvern, Ark., has sold the

Anodize

RIVETS • BOLTS • WASHERS • SCREWS in ONE Basket

Batches of rivets, bolts, washers and screws can be anodized in one Nankervis basket without mixing. Perforated spacer plates keep each lot separate — eliminating time-consuming sorting. Nankervis anodizing baskets last longer, too! Write for bulletin A-1.





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METAL FINISHING EQUIPMENT
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PROMPT DELIVERY on DEGREASERS and TANKS

DEGREASERS MANUAL AUTOMATIC

COMPLETE EQUIPMENT FOR . . .
- *Anodizing*
- *Phosphating*
- *All Plating Processes*

PLASTIC WAX MELT TANKS

AGITATORS

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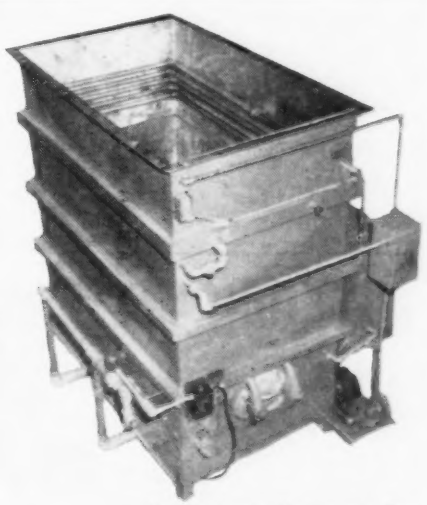

Vapor Spray Degreaser Gas Heated with Safety Pilot and Thermostatic Control.

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latter firm to *Universal Die Casting Co.*, of Michigan. He has re-entered the manufacturing field in Southern California with a plant at 116th Street and Broadway, Los Angeles, which is equipped for the production of stainless steel flush valves.

Mr. and Mrs. James Beckwith, of Kent, O., parents of *Glenn Beckwith*, general manager of *Metallon Corp.*, Huntington Park, Calif., were guests of their son during a six weeks visit to California in January and February. The senior Beckwith was for 44 years a railroad engineer with the Erie Railroad, and now lives in retirement as a gentleman farmer near Kent, Ohio.

THANK YOU MR. McHENRY!*

"I received my first lesson and I like it very much. I have polished and plated for over forty years so you know I know something about the business. I also know I am going to learn much more than I know now, by taking the course."

*Thanks for writing a far better ad for ELECTROPLATING KNOW HOW than I ever could. Joseph B. Kushner, Plating Engineer, Stroudsburg 2M, Pa.

Frank Lammens, for 15 years a plater with *Modern Plating Co.*, Chicago, has moved to California and is now a member of the shop crew of *Travis Plating Co.*, Venice, a Los Angeles seaside district. Frank is a member of Chicago Branch, AES, but plans to transfer to Los Angeles Branch.

Beckman Instruments, Inc., South Pasadena, Calif., has acquired 40 acres of land at La Habra, Calif., as the site for a proposed new plant in which it is proposed ultimately to consolidate all the divisions of the firm which are now occupying some 14 different buildings in the Pasadena and South Pasadena districts.

Dr. A. O. Beckman, president, announced that the various units of *Beckman Instruments, Inc.*, *Arnold O. Beckman, Inc.*, and *Helipot Corp.*, will be moved to the La Habra plant as the facilities are completed.

Revere Copper & Brass, Inc., announces that plans are in the making for erection of plant facilities that will enable the firm to produce aluminum and aluminum alloys as well as copper and copper alloys. A plant addition of 50,000 square feet is contemplffiated, at Los Angeles, it was reported, for production of aluminum tube and extruded shapes in various alloys, both heat-treated and non-heat treated.

J. B. Sebrell, candidate for Congress and owner of several businesses in Southern California, including the J. B. Sebrell Advertising Agency of Los Angeles, was the principal speaker at the first 1952 meeting of the *Metal Finishing Association of Southern California*, held January 21 at the Rodger Young Auditorium.

Speaking on the subject "Why Nine Out of Ten Firms Fail," Mr. Sebrell pointed out that many firms do not realize the full benefits from advertising dollars because of their failure to follow up properly. He also reminded the plating shop owners that burdening themselves with voluminous details rather than hiring proper personnel to take care of detail work was, in many cases, a false economy. He warned the platers that, in their business as well as in most others, it is necessary "to get out and sell to stay in business."

NEW BOOKS

Corrosion Testing

By Francis L. LaQue. Pub. by A.S.T.M., 1916 Race St., Phila. 3, Pa. Price $1.50. 96 pages. Paper bound.

The 1951 ASTM *Edgar Marburg*

Hartford
GUARANTEED
STEEL BALLS
Best for Burnishing . . . Perfect for Polishing. No culls, no cracks.
Mixtures as Required
THE HARTFORD STEEL BALL CO.
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PERIODIC-REVERSE UNITS
Of the Finest Quality for
PLATING
In the Modern Way
Write for Information
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CORROSION-PROOF LININGS CEMENTS BRICK
• TANKS, FLOORS, FUME DUCTS AND PROCESS EQUIPMENT
• COMPLETE LINE OF PROTECTIVE COATINGS . .
Over a Quarter Century of Experience
CEILCOTE CORROSION-PROOF MATERIALS • CONSTRUCTION • SUPERVISION
The CEILCOTE Co. 4832 RIDGE RD. CLEVELAND 9, OHIO

Lecture. "Corrosion Testing," by *Francis L. LaQue*, in charge of Corrosion Engineering Section, Development and Research Div., The International Nickel Co., Inc., New York, has just been published in the form of a 96-page profusely illustrated booklet.

This excellent and informative lecture comprises a survey of corrosion-testing programs and methods of corrosion testing, many of which have been sponsored by the American Society for Testing Materials. Mr. LaQue, one of the best known authorities on the practical aspects of corrosion phenomena, discusses the distinction that must be made between the corrodibility of a material and the protective value of its corrosion products and how these are influenced by both the composition of the material and the incidental conditions of its exposure.

Some of the topics touched on in the book are as follows: atmospheric corrosion studies; relations between rust color and corrosion; effects of alloying elements on the resistance of steels and irons to atmospheric corrosion; comparison of atmospheres; and galvanic corrosion. Also discussed are a variety of tests such as: acid, accelerated, atmospheric galvanic, salt spray, laboratory total immersion and alternate immersion, boiling nitric acid, plant corrosion, paints, etc.; tests in waters; corrosion tests of insect screens; long-time tests of different steels and irons; and effects of position in test.

Mr. LaQue is chairman of the ASTM Advisory Committee on Corrosion, serves on a number of other ASTM technical committees, and represents ASTM on the Inter-Society Corrosion Committee of the National Association of Corrosion Engineers.

Industrial Heat Transfer

By F. W. Hutchinson. Pub. by The Industrial Press, 148 Lafayette St., New York 13, N. Y. Price $6.00. 336 pages. Buckram Binding.

The feature of this book is 128 working charts from which a direct solution of heat transfer problems can be obtained for 70 industrial fluids ranging from air and acetylene to sulfur dioxide and water. These graphs are equal in accuracy to the equations from which they are derived.

Each chapter in the book consists of three parts. At the beginning of each chapter the fundamental theory is discussed and the equations relating to the evaluation of heat transfer coefficients and rates are developed. At the end of the chapter are presented the graphs referred to in the foregoing.

The six chapters in the book are: Introduction, Conduction, Radiation, Convection, Combined Heat Transfer, and Forced Convection. The chapter on forced convection will be of particular value to the practicing engineer since it covers forced convection of gases and liquids whether heating or cooling within or outside of pipes.

Professor Hutchinson's book is a valuable textbook for students of heat transfer, and a useful working handbook for parcticing engineers who must make accurate calculations of heat transfer co-efficients and rates in designing or specifying actual installations. The time saved in solving problems by the graphical method will be readily appreciated.

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TURKISH EMERY

This old time famous brand of emery is now in stock. Many have been waiting for it. Also available are POLISHING ABRASIVE —best for finest finishing and AMERICAN EMERY—most economical.

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SOMMERS BROS. MFG. CO.

MFRS. OF "BEACON"

Plating and Polishing Supplies and Equipment —Complete Semi and Full Automatic Installations—Gold, Silver and Chrome Rouge, Stainless Steel and Satin Finish Compounds—Buffs, Polishing and Felt Wheels.

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